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COLUMBIUM - AND RARE-EARTH ELEMENT-BEARING DEPOSITS AT BOKAN MOUNTAIN, SOUTHEAST ALASKA

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UNITED STATES DEPARTMENT OF THE INTERIOR

Manuel Lujan, Jr., Secretary

BUREAU OF MINES

T.S. Ary, Director

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UNIT OF MEASURE ABBREVIATIONS USED IN THIS REPORT

cps	counts per second of gamma ray radiation
ft	foot
ft^3	cubic foot
g	gram
in	inch
lb	pound
mi	mile
mm	millimeter
MM	million
pct	percent
ppb	parts per billion
ppm	parts per million
st	short ton
t oz	troy ounce
yd^3	cubic yard

COLUMBIUM- AND RARE-EARTH ELEMENT-BEARING DEPOSITS AT BOKAN MOUNTAIN, SOUTHEAST ALASKA

By J. Dean Warner[1] and James C. Barker[2]

*** ABSTRACT

From 1984 through 1987, the Bureau of Mines investigated numerous prospects and new discoveries of columbium, rare-earth elements (REE), uranium, zirconium, and other metals associated with the multi-phased peralkaline granite at Bokan Mountain, southeastern Alaska. This report summarizes the mineral evaluations and estimates indicated and inferred resources for those prospects containing significant tonnage and grade. A total of approximately 96.2 MM lb Cb_2O_5 (43 pct of the tonnage at a grade exceeding 0.125 pct Cb_2O_5), and 11.8 MM lb U_3O_8, 27.9 MM lb ThO_2, 133.0 MM lb Y_2O_3, 637.6 MM lb ZrO_2, and 241 MM lb REO are estimated to be contained within nine deposits totalling 37.8 million tons (at least 80 pct of resource tonnage also exceeds 0.5 pct Y_2O_3 + REO). Generally, half of the REO content is composed of the heavy yttrium subgroup. Several deposits also contain beryllium and tantalum; 2.1 MM lb of Ta_2O_5 and 8.9 MM lbs of BeO were estimated. These estimates would likely be substantially increased with additional exploration. Four deposit types were investigated; shear zones and fracture-related deposits, pegmatites, mineralized dikes, and placers. Mineralized dikes contain most of the beryllium, columbium, tantalum, yttrium, zirconium, and REE resources, whereas shear zones and fracture-related deposits (Ross-Adams mine) contain the principal of the uranium resource. Pegmatites are similarly mineralized as are dike deposits, and contain low levels of gold. Placer potential is suggested, but no deposits were found.

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*** INTRODUCTION

Radioactive mineral deposits near Bokan Mountain, southeastern Alaska, were investigated for concentrations of columbium, rare-earth elements, and associated metals by the Bureau of Mines during portions of the summers of 1984 through 1987. Investigations initially focused on evaluation of prospects previously known only for uranium and thorium contents. During the course of field investigations, however, previously undocumented mineralization was also located and evaluated. Evaluations included limited geologic and radiometric mapping at various scales and sampling of mineralized zones. Selected samples were also studied by petrographic, X-ray diffraction (XRD), and scanning electron microscope (SEM) methods for mineralogic and textural characterization.

Investigations at Bokan Mountain were conducted as part of a Bureau project to identify and assess Alaskan reserves or resources of certain critical and strategic minerals or metals, among which is columbium, that could be extracted during periods of prolonged national shortage. Columbium is used widely as a hardening alloy in high-strength, low-alloy steels and is considered of critical and strategic importance to the United States because of its applications in national defense and petroleum industries and because the country is entirely reliant on foreign sources of the metal (1)[3/]. Until 1961, the world's major source of columbium was placer deposits in Nigeria, however, the United States presently imports most of its columbium from Brazil and Canada where it is mined from lode sources. The United States consumes about 15 pct (5 MM lb Cb) of the worlds annual[4/] demand of approximately 33 MM lb.

Rare-earth elements (REE) are also present in most of the deposits at Bokan Mountain. Technically, the REE are a group of 15 chemically similar elements consisting of the lanthanide-series elements, atomic numbers 57 through 71. These elements are often subdivided into two groups based on similarities in chemical properties or atomic numbers: 1) the light REE (cerium subgroup) consists of elements with atomic numbers 57 through 63, and 2) the heavy REE consists of elements with atomic numbers 64 through 71 (see table 1, footnote 2). Because of similarities in chemical properties, the heavy REE are often grouped with yttrium (atomic number 39) and referred to as the "yttrium" subgroup. The REE have a wide range of applications in catalysts, metallurgy,

3/Underlined numbers in parentheses refer to the list of references preceding the appendix at the end of the report.

4/1986 estimate (1).

TABLE 1. - Commodities present and typical range of values[1] in samples from deposits at Bokan Mountain.

Metal	Shear Zones and Fracture-Controlled Deposits	Pegmatite Deposits	Dike Deposits
RANGE OF PRINCIPAL COMMODITIES, PCT (HIGHEST VALUE)			
Columbium (Cb)	0.01-.05 (.12)	.04-.2 (.6)	.06-.4 (2.8)
Thorium (Th)	.4->1.0 (12.8)	.01-.04 (.12)	.02-.12 (.78)
Uranium (U)	.17-.75 (2.39)	.005-.04 (.06)	.02-.04 (.12)
Zirconium (Zr)	.2-.28 (1.0)	.1-6 (9.7)	.2-2.2 (4.6)
Yttrium (Y)	.3-.8 (3.0)	.02-.2 (.4)	.2-.8 (2.0)
Rare-earth elements (REE)[2]	.1-.3 (.56)	.15-.5 (.88)	.2-1.3 (4.01)
RANGE OF MINOR COMMODITIES, PPM (HIGHEST VALUE)			
Barium (Ba)	100-500 (1000)	80-300 (3000)	100-300 (4000)
Beryllium (Be)	10-40 (540)	5-40 (380)	30-110 (2000)
Hafnium (Hf)	20-40 (69)	200-600 (1600)	70-200 (530)
Gallium (Ga)	N-20 (40)	N-20 (20)	N-20 (90)
Germanium (Ge)	N-10 (10)	10-20 (50)	10-30 (90)
Gold (Au)	N-.03 (.44)	N-.3 (71.5)	N-.08 (.5)
Lead (Pb)	20-100 (1 pct)	N-100 (2000)	100-400 (6000)
Lithium (Li)	N-500 (>2000)	N-200 (>6000)	N-1000 (>7000)
Palladium (Pd)	NA	NA	(.24)
Rubidium (Rb)	N-250 (310)	300-400 (450)	50-300 (2600)
Silver (Ag)	N .4 (9.1)	N-1.0 (11.16)	N-2 (2.5)
Strontium (Sr)	N 20 (4000)	N-30 (1000)	N-50 (1800)
Tantalum (Ta)	8-15 (100)	20-100 (230)	40-200 (590)
Tin (Sn)	5-10 (26)	N-75 (120)	10-200 (400)
Titanium oxide (TiO_2)	1000-2500 (3800)	1000-6000 (1.0pct)	1000-8000 (1.45pct)
Vanadium (V)	10-30 (40)	10-20 (200)	10-50 (570)
Zinc (Zn)	200-300 (6000)	100-300 (2000)	300-3000 (6000)

N Not detected NA Not analyzed

[1]Ranges are subjectively determined and do not necessarily reflect the grade of any particular prospect. Deposit classification, used here, and grades are discussed at length in a later section of the report.

[2]Includes, in order of increasing atomic number:

Cerium Subgroup (Light REE)	Yttrium Subgroup (Heavy REE)
Lanthanum (La)	Gadolinium (Gd)
Cerium Ce)	Terbium (Tb)
Praseodymium (Pr)	Dysprosium (Dy)
Neodynium (Nd)	Holmium (Ho)
Promethium (Pm)	Erbium (Er)
Samarium (Sm)	Thulium (Tm)
Europium (Eu)	Ytterbium (Yb)
	Lutetium (Lu)

magnets, lighting, phosphors, glass and optics, and electronics. Recent research in the field of superconductors and metal-oxide ceramics has been dramatically advanced by use of various REE compounds. The United States is self-reliant in the lighter REE, however, most of our heavy REE including yttrium are imported. Significantly, many of the deposits investigated at Bokan Mountain, in contrast to REE deposits elsewhere in the United States, are enriched in the heavy REE.

Besides columbium and REE, the Bokan Mountain deposits generally contain uranium, thorium, and zirconium (with associated hafnium) as principal commodities. Beryllium occurs in the southern deposits and a tantalum resource was calculated for the northern-most deposit. There is also a host of other possible by-product metals present. Table 1 summarizes all commodities present in deposits at Bokan Mountain and the general range of values. Note that sample values presented in this report were mostly determined by a neutron activation procedure. Due to the self-shielding effect (see discussion in "Nature of Bureau Investigations") when high values of REE are present, the reported sample values, as well as estimates of resources, are considered minimal. The deposits contain elevated concentrations of numerous commodities, therefore, some of the report's discussion concerns metals other than columbium and REE that may be recoverable as co- or by-products.

Many of the deposits at Bokan Mountain have no close counterpart described elsewhere in the world, therefore, geological extrapolations are difficult and it is presently uncertain if the valuable minerals can be economically recovered. Metallurgical testing of large samples of potential ore collected from some of the prospects (appendix C) at Bokan Mountain is underway at the Bureau research centers in Salt Lake City, Utah, and Albany, Oregon. Until recoverability can be assured, the Bokan deposits must be regarded as resources, not reserves, and they will be termed accordingly in this report.

The Bureau's critical and strategic metal studies are typically multidisciplinary, involving geologic field evaluations as well as characterization and beneficiation research. This is the first of several reports describing Bureau investigations at Bokan Mountain. This report gives results of field investigations of columbium- and rare-earth-element-bearing prospects and includes geological descriptions and sampling results as well as resource estimates. The following reports will describe ore mineral characterization and results of extractive metallurgical testing.

*** ACKNOWLEDGMENTS

Bureau investigations at Bokan Mountain were supported by many people. Special thanks is owed Robert, Irene, and Ray Dotson, prospectors from Ketchikan, Alaska, who initially introduced us to many of the area's prospects, provided invaluable logistical aid, and helped the Bureau secure permission for work in the area from other Bokan area claim holders. Troy Erwin and Frank Tillotson, also prospectors from Ketchikan, Robert Serephim, geological consultant from Vancouver, British Columbia, Dennis Krantz, exploration geologist, and Boris Gresof, exploration manager of Standard Metals Corporation, also provided information about and permission to visit some of the area's prospects. David Gaard, geologist with Nerco Minerals Company provided discussions and unpublished data on the I and L prospect. Lastly, discussions or correspondence with Dr. Tommy Thompson, professor at Colorado State University, Colorado, Dr. Richard Lee Armstrong, professor at the University of Vancouver, British Columbia, Canada, and Dr. Bernard Collot, Exxon Production Research Company, Houston, Texas, helped to clarify ideas about the geology of the Bokan Mountain peralkaline granite.

*** LOCATION, ACCESS, AND PHYSIOGRAPHY

Bokan Mountain is located on southeastern Prince of Wales Island, approximately 36 mi southwest of Ketchikan in the north-central portion of the U.S. Geological Survey 1:63,360 scale Dixon Entrance (D-1) Quadrangle (fig. 1). The Bokan Mountain area is accessible year-round from ice-free tidewater on either the West Arm of Kendrick Bay, to the southeast, or the South Arm of Moira Sound, to the northwest (fig. 2). A barge-loading dock and camp facility is located near the head of the West Arm of Kendrick Bay where a maintained mine road and flagged trails lead to many of the prospects. From the South Arm of Moira Sound, prospects are accessible by boat and foot.

The prospect area extends over a vertical relief of 2,500 ft, from tidewater to the summit of Bokan Mountain (fig. 2). Lower elevations support a dense rain forest of spruce, cedar, and hemlock trees, with growths of devils club, salmonberry, and other bushes along drainages. Flatter areas often contain muskeg or ponds. Higher elevations, generally underlain by granite, are sparsely vegetated and characterized by bare, rocky slopes. A tarn occupies a west-facing cirque on the mountain's western side. Principal creeks and many of the nearby inlets, sounds, and bays follow U-shaped valleys that were once sites of valley and tidewater glaciers.

*** HISTORY AND PRODUCTION

Radioactivity was first detected at Bokan Mountain in May, 1955, during an airborne radiometric survey conducted by Mr. Don Ross of Ketchikan, Alaska (2). Together with Kelly Adams, also of Ketchikan, high-grade uranium mineralization was subsequently confirmed by ground prospecting and claims were staked. Open pit mining of the Ross-Adams ore body commenced in July, 1957. Between then and 1971, a total of 87,331 st of ore with a weighted average of 0.76 pct U were produced during several periods of mining (table 2).

Although uranium has been the only commodity produced, the presence of other commodities in the Ross-Adams ore and at several other prospects in the area was soon recognized. In 1959 and again in 1963, MacKevett reported spectrographic analyses for nine samples of Ross-Adams ore containing elevated values of columbium, REE, thorium, and zirconium, in addition to uranium (5, 3), and described several prospects near Bokan Mountain that had been discovered after location of the Ross-Adams ore body (3). MacKevett recognized four types of mineralization: 1) veins or replacement deposits containing uranium-thorium minerals of hydrothermal origin in or near fractures; 2) concentrations of uranium-thorium-bearing accessory minerals in the peralkaline granite; 3) disseminated uranium-thorium minerals that are syngenetic in pegmatite or aplite dikes; and 4) uranium-thorium minerals of hydrothermal origin occupying interstices in clastic metasedimentary rocks

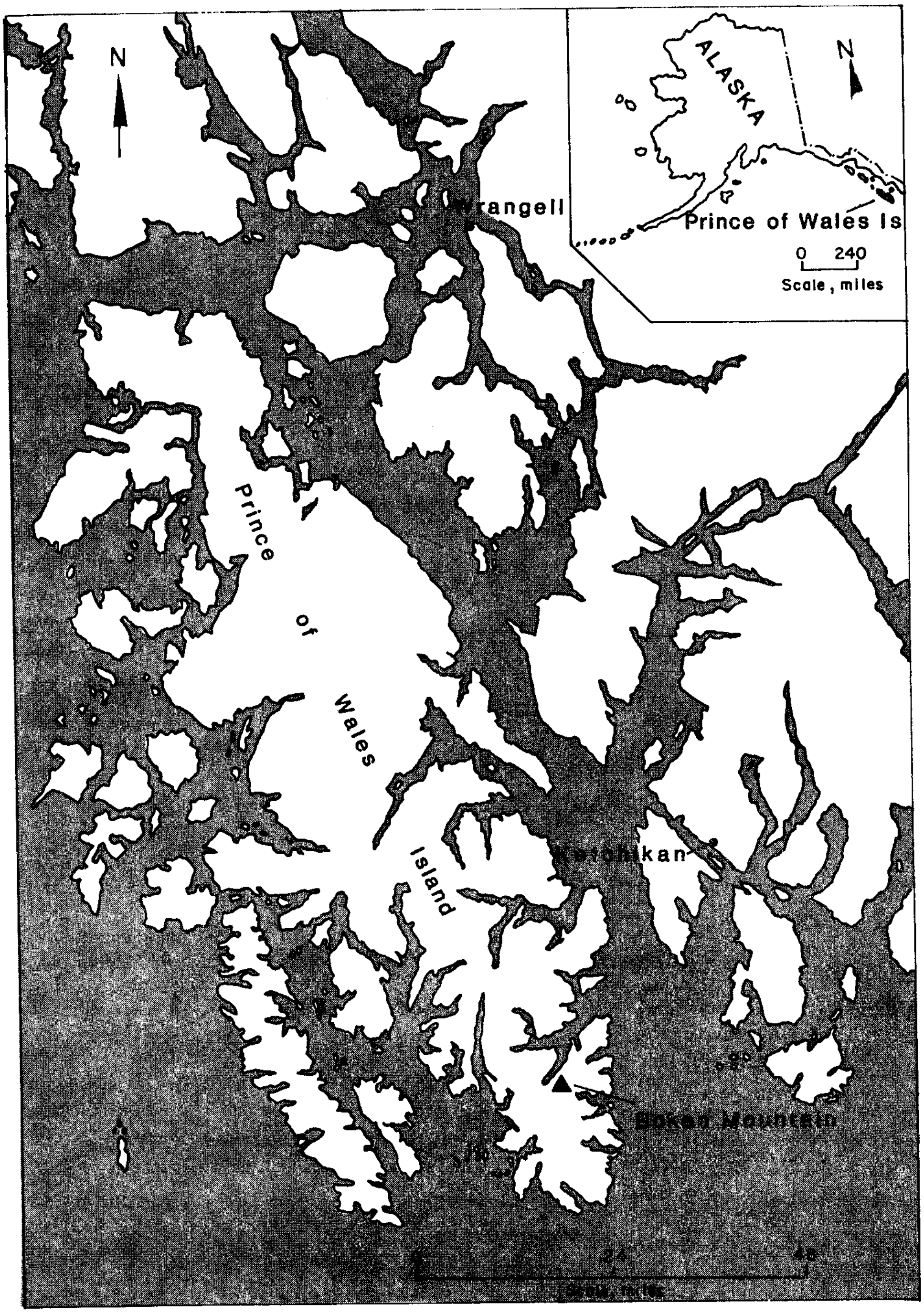


Figure 1 - Location of Bokan Mountain in southeast Alaska.

TABLE 2. - Production from the Ross-Adams mine

Date or Period	Company	Production: Tons	Production: U_3O_8, lbs	Grade U_3O_8, pct	Reference
1957	Climax Molybdenum Corp.	15,000	315,000	1.05	(3)
1959-1964	Standard Metals Corp. and others	15,000	300,000	1.0	(2)
1971	Newmont Exploration, Ltd.	55,600	687,000	.62	(4)
Total or weighted average		85,600	1,302,000	.76	NAp

NAp-Not applicable

PROSPECT LOCATIONS

Prospect(s)	Figure(s)
Ross Adams	4,5
Sunday Lake	6
I and L No.1 and Wennie	7
Other occurrences (i.e., Dotson Shear Zone)	8
Northwestern Bokan Mountain (i.e., Boots Prospect)	9
ILM	10
Little Jim (no figure)	X
Little Joe	11
Irene D	12
Geiger	14 thru 16
I and L	17 thru 22
Dotson	24
Cheri	27
Upper Cheri	28
Geoduck and Shore	29
Kendrick Bay Placer	30

Purple Plepy

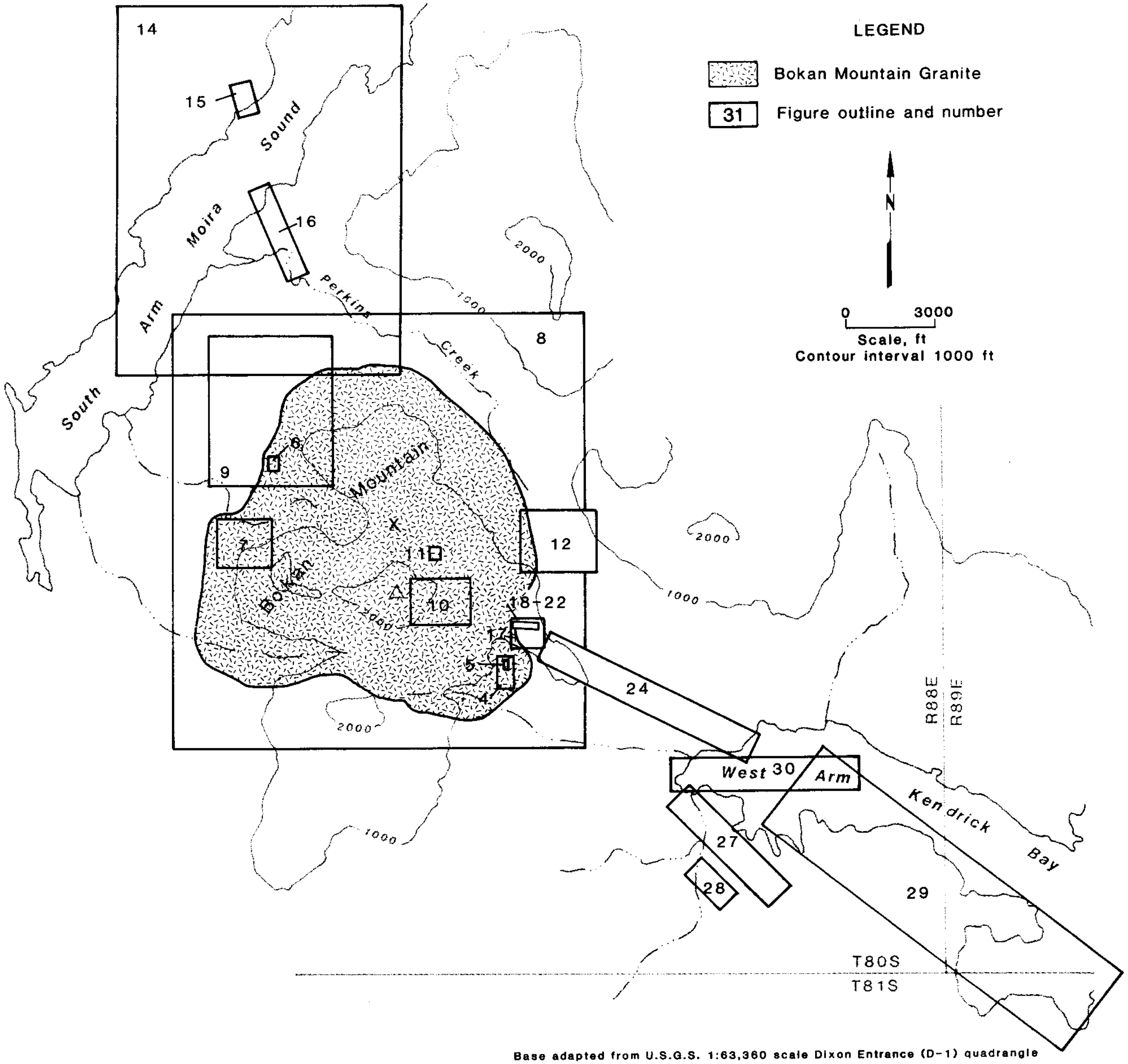


Figure 2 - Bokan Mountain area and locations of prospects.

(5, pg. 1). MacKevett collected 27 samples from nine prospect sites other than the Ross-Adams mine and found generally higher values of columbium, REE, and zirconium, but lower values of uranium and thorium than those found in samples of the Ross-Adams ore.

In 1976 and again in 1978, Staatz (6, 7) described mineralization in the I and L and Dotson prospects, which he refers to collectively as the "I and L vein system." Traced for in excess of 8,000 ft of strike length and exposed over 1,200 ft of relief, Staatz reported the veins contain "abnormally high" amounts of barium, beryllium, columbium, strontium, tin, and zirconium and "highly variable" thorium, uranium, and REE contents with samples containing from a few hundred parts per million (ppm) to several percent of each element. Staatz also identified thorium-bearing uraninite, branerite, thorite, allanite, bastnaesite, xenotime, monazite, pyrochlore, and columbite, among other minerals, in samples collected from the I and L vein system.

In 1980, in a study of the Bokan Mountain uranium-thorium deposits that concentrated on the geology and mineralization of the Ross-Adams mine, Thompson and others (8) found that columbium, manganese, rubidium, yttrium, and zirconium attain maximum concentrations in partially altered rocks of an enrichment halo adjacent to the uranium-mineralized zone at the Ross-Adams mine.

In 1980, Staatz and others (9) estimated identified resources of 1,440 st ThO_2 and 420 st U_3O_8 and probable potential resources of 2,320 st ThO_2 and 820 st U_3O_8 in 16 vein or pipe-like deposits in the Bokan Mountain area. The grade of most of these deposits was at least 0.2 pct ThO_2 and between 0.06 pct and 0.55 pct U_3O_8. Staatz also reported that ten of the deposits have REE reserves of approximately 18.6 MM lb and "possible potential" resources of 18.7 MM lb with grades generally at least 2.0 pct REO. Preliminary grades of vein deposits were determined from 44 samples.

*** GEOLOGIC SETTING

Bokan Mountain is underlain by a multiple phase peralkaline[5/] granite intrusion of Jurassic age (10, 11) (fig. 3). The intrusion is crudely

5/Molecular proportion of $K_2O + Na_2O$ exceeds that of Al_2O_3.

circular in outcrop, covering an area of approximately 3.5 mi^2 over a relief of 2,200 ft, and has sharp country rock contacts that dip outward. Thompson and others (12) interpret the Bokan Mountain granite as a ring-dike complex consisting of riebeckite-(Na-bearing amphibole) and aegirine-(Na-bearing pyroxene) bearing granite, surrounded in turn by aegirine granite, aegirine granite porphyry, and finally by a border zone pegmatite. Syenite occur at depth and biotite aplite occurs on the south and northern perimeter. In contrast, Collot [as reported by De Saint-Andre (11)] interprets the granite as the apex of a shallowly eroded, large composite intrusion with great textural heterogeneity.

In brief, the Bokan granite is comprised of an outer zone of albitic aegirine-riebeckite granite rimmed by a discontinously exposed contact border zone of riebeckite-aegirine pegmatite and biotite aplite. The albitic aegirine-riebeckite granite grades inward to a core of texturally diverse riebeckite and/or aegirine granite and fine-grained riebeckite granite

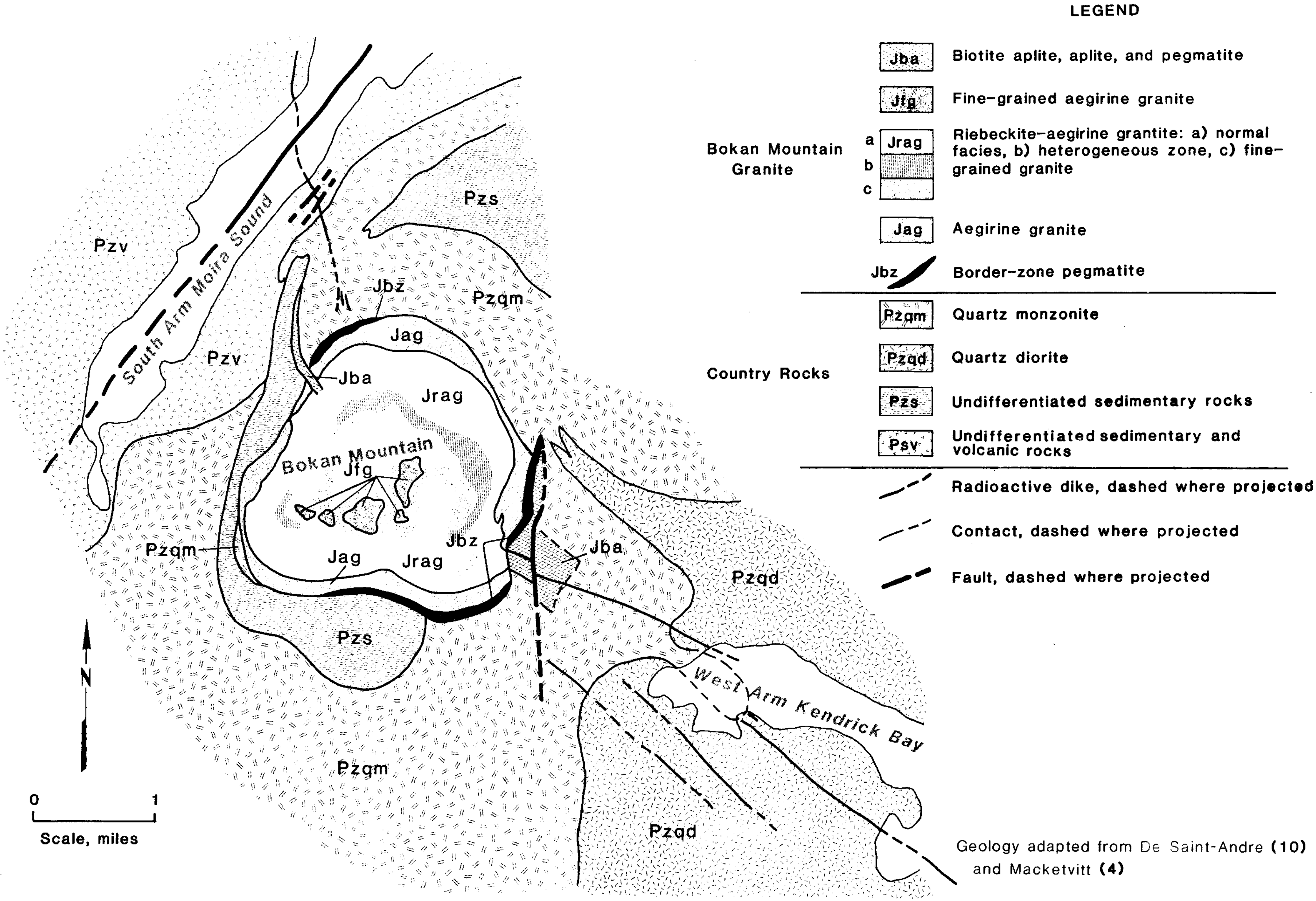


Figure 3 - Geology of the Bokan Mountain granite.

porphyry (fig. 3). Aegirine syenite of unknown extent is also exposed in the underground workings of the Ross-Adams mine. Accessory minerals in the granite include zircon, ilmenite, magnetite, allanite, xenotime, monazite, fluorite, uranothorite, and thorite.

The Bokan Mountain granite intrudes or occurs in close proximity to a diverse assemblage of lower to middle Paleozoic-age igneous and metasedimentary rocks including diorite, quartz diorite, granodiorite, and quartz monzonite and units of slate, gneiss, schist, and metavolcanic rocks (3) (fig. 3). Near Bokan Mountain, the intruded country rocks along with the outer rim of the granite itself, show pervasive albite alteration.

All of the rocks near Bokan Mountain are cut by dikes of a variety of compositions including andesite, dacite, basalt, lamprophyre, quartz monzonite, rhyolite, aplite, and quartz latite. Some of the more felsic dikes are radioactive, containing large amounts of accessory columbium, REE, thorium, and zirconium minerals, and are likely genetically related to the Bokan Mountain peralkaline granite.

Bokan Mountain is underlain by one of several poorly documented syenite-, alkaline granite-, or carbonatite6/ complexes that outcrop along a general north-west trend on southern Prince of Wales Island. Other complexes include rocks at Stone Rock Bay, Mallard Bay, McLean Arm, northward to Dora Bay and perhaps beyond as far as Salmon Bay. The other complexes are largely unexplored, but their general composition suggests they have potential for mineralization similar to that at Bokan Mountain.

6/Carbonatite rock of magmatic origin often associated with alkalic igneous rocks.

*** TRACE ELEMENT ANALYSES OF THE PERALKALINE GRANITE

Several samples of various unaltered phases of the Bokan Mountain granite were collected in order to: 1) investigate the distribution of trace elements in the granite as they may apply to primary disseminated lode deposits and potential sources of placer deposits, 2) determine if any correlation between any particular phase of the granite and any type of mineral deposit exists, and 3) compare the Bokan Mountain granite with the composition of average biotite granites and known columbium-bearing peralkaline granites elsewhere in the world. The mean and range of element values found in samples are compiled in table 3. Although some variation in trace element content between phases of the granite is apparent, the limited sample set prevented a statistical comparison. The elemental concentrations for all of the sampled phases generally range to several times the average concentration in biotite granite, attesting to the uniformly enriched nature of the Bokan Mountain peralkaline granite, however, in all cases values are below those reported for riebeckite granite in Nigeria (13). No disseminated primary lode deposits are suggested by the analyses and no correlation of deposit type (discussed in a later section) to a particular granite phase is evident. Nevertheless, the generally high background values of elemental columbium and REE suggest the Bokan granite may be a lode source of potential placer deposits in neighboring streams and bays.

TABLE 3. - Mean (X) and range (R) of values in samples of Bokan Mountain granite.

	Phases of Bokan Mountain Granite (Number of Samples)								Nigeria[1]		World[2]
	Biotite Aplite in Jba (1)		Aegirine Granite in Jag (4)		Riebeckite Granite in Jarg (7)		Riebeckite Aplite in Jarg (2)		Riebeckite Granite		Biotite Granite
Element	X	R	X	R	X	R	X	R	X	R	X
Cb, ppm	120	NA	100	60-150	79	40-140	50	N-100	350	N	20
Th, ppm	45	NA	39.5	12-90	28.8	ND-80	<30	NA	55	N	20
U, ppm	14	NA	10.9	8.6-13	10.0	7.9-15.2	7.5	6.4-8.5	N	N	3.9
Y, ppm	D	NA	115	ND-240	80	ND-240	N	NA	420	N	41
Zr, pct	.02	NA	.11	.02-.17	.08	.02-.16	.10	.05-.16	.13	N	.02
REE, ppm	D	NA	305	100-500	250	100-360	200	200-300	500[3]	N	112[3]

NA Not Applicable. ND Not Detected. D Detected. N Not Available.

[1]As reported by Bowden (13)

[2]As reported by Rose (14)

*** NATURE OF BUREAU INVESTIGATIONS

SAMPLING METHODS AND ANALYTICAL TECHNIQUES

Although the flanks of Bokan Mountain below approximately 1,200-ft elevation are covered by dense forest, numerous prospect pits and outcrops provide moderately good exposures of many of the mineral occurrences and prospects. Above an elevation of approximately 100 ft, the ground mat vegetation typically lies directly on bedrock or bedrock rubble and many exposures can be readily cut with hand-trenching tools. Below an elevation of 100 ft, however, bedrock is often covered by glacial till and colluvium, except along shorelines where bedrock has been exposed by wave action.

Samples collected during this investigation generally consisted of channels of a uniform volume of rock or continuous rock chips across mineralized zones. Samples collected to determine background metal concentrations, however, were collected as random rock chips from larger areas. Limited drill coring of a few prospects was also conducted. This included AX (1 3/16 in core diameter) coring by the Bureau on the Dotson prospect and coring by property holders on the Ross-Adams, I and L, and Irene-D deposits. Mineralized areas were systematically tested for gamma-ray radiation levels with a Mount Sorpris model SC-132 portable scintillation counter with an upper detection limit of 20,000 cps and a Scintrex model G15-5 gamma-ray spectrometer with an upper detection limit of 29,000 cps[7].

7/Use of trade name does not imply endorsement by the Bureau of Mines.

Samples collected at Bokan Mountain were analyzed by two laboratories. Analytical techniques and detection limits for each laboratory are summarized in table 4. Samples collected in 1984 and 1985 were quantitatively analyzed at the Bureau's Reno Research Center in Reno, Nevada, for columbium, tantalum, tin, uranium, thorium, gold, silver, gallium, hafnium, platinum, palladium and molybdenum, beryllium, and rubidium. The entire REE group was analyzed by a specifically designed semi-quantitative procedure utilizing a 3.4 meter Wadsworth-type spectrograph. In this method the D.C. arc spectra of samples, diluted with a graphite/gallium buffer-internal standard, is compared to the spectra of synthetic REE standards using a densitometer. All 1984 and 1985 samples were also semi-quantitatively analyzed for a suite of 40 elements by standard emission spectrography.

In tables and illustrations to follow, sample sets from each prospect are distinguished by numeric prefixes. For example, samples collected at the Ross-Adams mine are numbered 1-1 through 1-27 whereas samples from the Sunday Lake prospect, which is the next prospect described, are numbered 2-1 through 2-15. Analytical results are presented in tables 7 through 27 and appendix B. Those samples analyzed commercially are noted on each table.

ANALYTICAL INTERFERENCE, LIMITATIONS, AND SELF-SHIELDING

Samples collected in 1986-1987 were analyzed at a commercial laboratory for a package of 42 elements by a variety of analytical techniques. Notably,

TABLE 4. - Analytical methods and detection limits.

Element(s)	Analytical Method	Detection Limit, ppm
Samples Analyzed by the Reno Research Center, USBM		
Ag[1], Au[1]	FA/ICP	0.30, .007
Cb, Ge[1], Ta	XRF	50, 20, 100 or 80[2]
Mo[1]	AA	15
40 elements[3]	Spec	varies, approx. 100
Y, Yb	Wadsworth Spec	10
La, Tm		20
Gd, Dy(1984), Ho (1984)		50
Eu, Lu, Er (1985)		100
Ho (1985)		
Dy(1985)		400
Ce(1984), Er (1984)		500
Nd(1984), Pr (1984)		
Ce(1985)		600
Nd(1985), Sm (1985)		700
Pr(1985), Sm (1984)		1000
Sn	XRF and AA[4]	50 and 5
U	F	0.5
Th	R	30
33 elements[5]	ICP	varies
Samples Analyzed by Commercial Laboratory		
Ag, B, Be, Bi, Cd, Cu, Ge, Mn, Ni, Pb, V, Zn	DCP	0.5, 100, 10.0, .5, .2, .5, 100, 2.0, 1.0, 2.0, 100, .5
As, Au, Br, Co, Cs, Hf, Mo, Sb, Sc, Se, Ta, Th, U, W, La, Ce, Nd, Sm, Eu, Yb, Lu	NA	2.0, .010, 1.0, 1.0, .5, 1.0, 5.0, .2, .1, 3.0, 1.0, .5, .5, 3.0, .5, 3.0, 5.0, .1, .2, .02, .05
Ba, Cr, Cb, Rb, Sr, Y, Zr, Al_2O_3, CaO, Fe_2O_3, K_2O, MgO, MnO, Na_2O, P_2O_5, SiO_2, TiO_2, LOI,	XRF	10.0, 10.0, 20.0, 20.0, 20.0, 20.0, 20.0, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100,
Li	AA	10.0

FA/ICP - Fire assay preconcentration/Inductively coupled plasma
XRF - X-ray fluorescence
AA - Atomic absorption
Spec - Emission spectrography
Wadsworth Spec - 3.4 m Wadsworth-type spectrograph
F - Fluoremetric
R - Radiometric
DCP - Direct current plasma
NA - Nuclear activation

[1]Analyses not performed on all 1984 samples.
[2]Improvement in analytical technique led to lower detection limit in 1985.
[3]Ag, Al, As, Au, B, Ba, Be, Bi, Ca, Cb, Cd, Co, Cr, Cu, Fe, Ga, K, La, Li, Mg, Mn, Mo, Na, Ni, P, Pb, Pd, Pt, Sb, Sc, Si, Sn, Sr, Ta, Te, Ti, V, Y, Zn, Zr.
[4]Specific extraction procedure.
[5]Ag, Al, As, Ba, Be, Bi, Ca, Cb, Cd, Co, Cr, Cu, Fe, K, La, Li, Mg, Mn, Mo, Na, Ni, P, Pb, Sb, Sn, Sr, Te, Ti, V, W, Y, Zn, Zr.

analyses of samples collected in 1986-1987 did not include either praseodymium or the heavy REE, (i.e. gadolinium, terbium, dysprosium, holmium, erbium, and thulium). Also, due to elemental interference in some samples collected in 1986-1987 that had high REE concentrations, some other elements could not be reliably detected.

Furthermore, during neutron activation analyses, REE values in samples with high concentrations of REE are reported by the laboratory to be low due to a self-shielding effect. The REE have a high absorption affect on the stream of activating neutrons during the irradiation procedure of neutron activation. As a result, samples with high concentrations of REE will disproportionately absorb activating neutrons along the outer surface of the sample mass while in effect shielding the inner portions of the sample from analysis.

To determine the extent to which the self-shielding effect may have underrepresented true REE content of samples presented in this report, a series of head assays were performed on 10 bulk samples from the I and L, Dotson, Cheri, and Ross Adams deposits. These samples range in size from 60 to 1700 lbs and were collected as representative chip samples of the mineralized bodies. Values are given in appendix C and were determined by ICP and XRF procedures using ore-grade standards. Samples listed in appendix C are undergoing further metallurgical testing and will be reported on by the Bureau's Salt Lake City Research Center at a later date.

RESOURCE ESTIMATION METHODS

Classification of resource estimates made at Bokan Mountain are according to definitions outlined in "Principals of a Resource/Reserve Classification for Minerals" (15). The estimates made in this report fall under the categories of indicated and inferred, identified resources. Because metallurgical recovery has not been established, no assessment of the economics of the deposit is warranted and no assignment in the "reserve" classification is made. "Indicated" resource estimates were made on those prospects or portions of prospects that were sampled in high-enough density and that had sufficient visible continuity to allow reasonable certainty of character of the deposit. "Inferred" resource estimates, on the other hand, are based on assumed continuity beyond the indicated resource for which there is geologic evidence and at least limited exposure and sample data.

General resource estimation methods are outlined in the following two paragraphs. It should be noted, however, that unique geologic characteristics of a few prospects required using other estimation methods; specific methods used on those prospects are described under individual prospect descriptions.

Most of the resource estimates calculated for this report were made on tabular bodies. Indicated resources were generally calculated by multiplying the known strike length of the occurrence by its average width. This value was then multiplied by one-half of the strike length (to approximate depth), divided by a measured tonnage factor, and lastly multiplied by the estimated grade of mineralization. Widths used to calculate the average were at least 3 ft, which is considered a minimum mining width. In cases where mineralization thicknesses or sampled intervals were less than 3 ft, measured grades were adjusted by assuming dilution from unmineralized wall rock. In some cases wall rock samples were collected and grade could be adjusted to a 3-ft-width by including the known wall rock metal values. Tonnage factors (ft^3/st) used are averages derived from measured samples listed in table 5 and are 11.3, 9.8, and 10.1 for pegmatites, dikes, and altered wall rock, respectively.

Inferred resources of tabular bodies were estimated by: 1) assuming continuity between areas of indicated resources where little or no sampling had been conducted, primarily due to the lack of outcrop, 2) projecting mineralized length by up to one-quarter of the total observable strike length in each direction, where geologically reasonable, 3) projecting depths up to one-half times the total inferred strike length of the mineralized body (a maximum depth of 2,500 ft is arbitrarily used as an ultimate limit of mining capability and geological inference) and 4) adjusting grade estimates where necessary to a minimum mining width of 3 ft as described above.

Analytical results of only those elements for which meaningful resource estimates could be made, including columbium, thorium, uranium, yttrium, zirconium, and REE are presented in tables 7 through 27 in the text. In some deposits, resources of beryllium and tantalum are also estimated. It is assumed that should mining take place, these commodities would be recovered as co-products. Except for beryllium (greater than 0.025 pct BeO) and tantalum (greater than 0.015 pct Ta_2O_5), no specific cut-off grades were used in the estimates. It is assumed that because the elements would be recovered as co-products, individual commodity grades could be lower than for deposits elsewhere in the world where commodities are recovered individually.

Analytical results of numerous other valuable elements that are present in trace or minor concentrations in some prospects (see table 1) are mentioned in the text and tabulated in appendix A. Should mining take place, some of those commodities may be recoverable as by-products. It is important to note, however, that commercial recovery of by-product commodities is highly dependent on their mineralogical form. Little data is presently available.

REE resource estimates are made on the basis of total REE content, exclusive of yttrium, for which separate estimates are made. Because the complete suite of REE was not analyzed for many of the samples and because reported REE values in those samples with high REE contents that were analyzed in 1986-1987 are low due to a self-shielding effect (see analytical techniques section) the REE resource estimates made here may be considered minimums.

PROSPECT EVALUATIONS

During this investigation, the Bureau evaluated 20 prospect areas, nine of which were found to be of sufficient size or grade to estimate resources. These occurrences can be grouped into four general types of mineral deposits: 1) shear zones and fracture-controlled deposits, 2) pegmatite deposits, 3) mineralized dike deposits, and 4) placer deposits. Admittedly, some of the deposits have characteristics of more than one of the major subdivisions. Other kinds of mineral deposits, most notably replacement greisen, and disseminated deposits are also present near Bokan Mountain, but only as minor or very low-grade occurrences. The prospects discussed in the following sections are summarized in table 6 according to deposit grouping.

Table 5. - Average measured tonnage factors.

Sample Description (number of samples)	Average Tonnage Factor, ft^3/st
Radioactive Dike(3)	9.8
Pegmatite (3)......	11.3
Wall rock (3)......	10.1

*** SHEAR ZONES AND FRACTURE-CONTROLLED DEPOSITS

Four prospects are considered to fall under the classification of shear zones and fracture-controlled deposits. With the obvious exception of the Ross-Adams mine, these are small occurrences with mineralization generally confined to radioactive northwest-trending iron- or manganese-stained fault zones. Mineralization is typified by thorium dominating over uranium. Most of the prospects also have sporadically high concentrations of heavy REE, especially yttrium.

ROSS-ADAMS MINE

General Description

The Ross-Adams mine is the only property in Alaska to have produced uranium. Approximately 86,000 st of ore averaging 0.81 pct U_3O_8 were produced during three periods of operation between 1957 and 1971 (see History and Production section for other details). "Probable" reserves of 365,000 st of ore grading 0.17 pct U_3O_8 and 0.46 pct ThO_2 were reported by Standard Metals Corp. in the late 1970's (16). The following description was compiled from MacKevett (3, 5), Stephens (2), Thompson (8), and unpublished Bureau data.

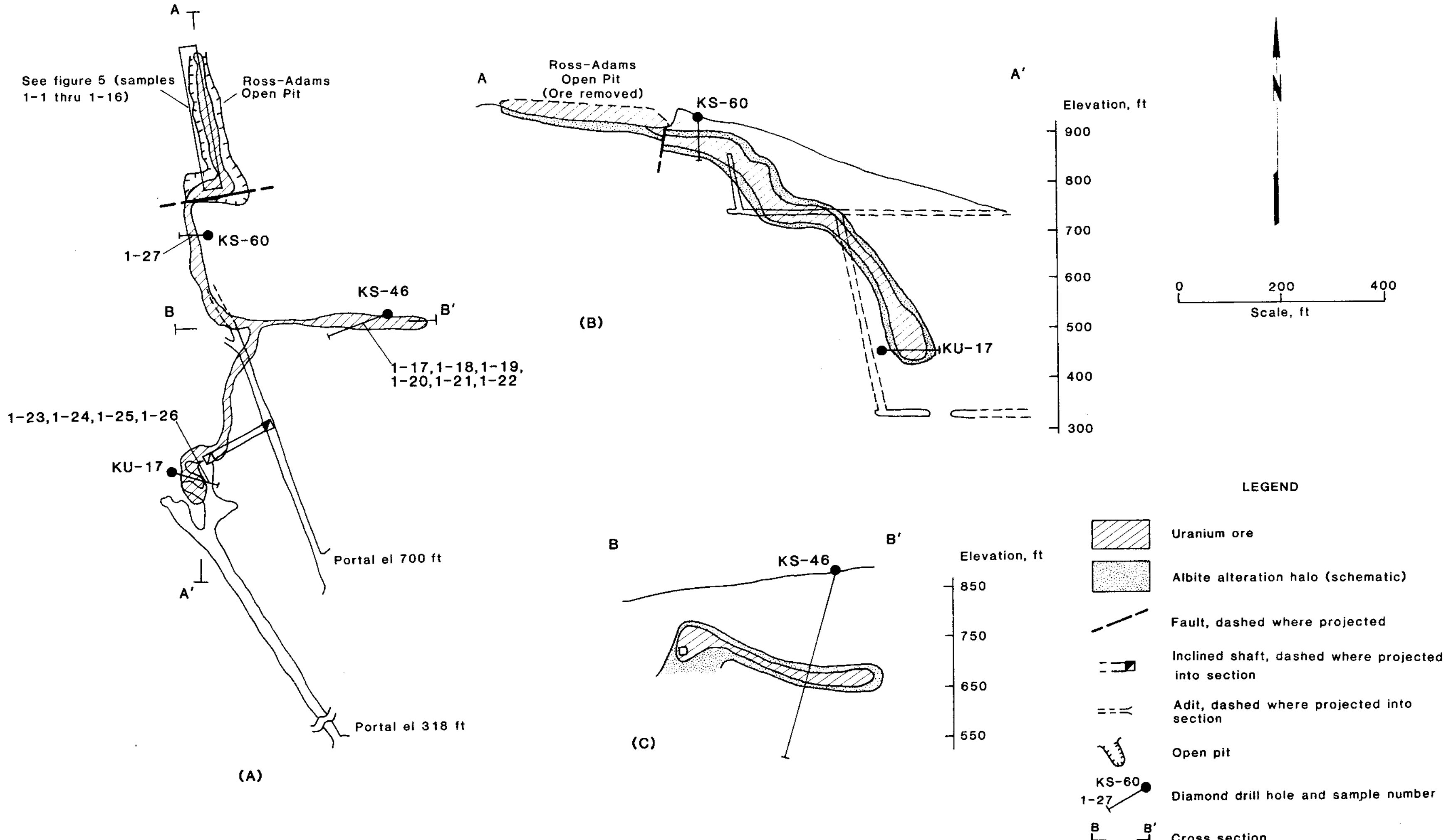
The Ross-Adams mineralization formed an irregularly shaped north-northwest-trending pipelike ore body that ranged from subhorizontal at its northern end to steeply south-dipping in its southern extremities (fig. 4). The northern 360 ft of strike length of the body was mined by an open-pit operation (180 ft of strike length was formerly exposed at the surface). This section of the deposit had an average width of 40 ft and maximum vertical dimension of 50 ft. On its southern end, the ore was cut and obliquely downthrown approximately 80 ft to the west by two west-northwest-trending faults. From this point the body plunged 50° to 60° south and continued for 365 ft. The southern portion of the ore body was removed by underground stoping with haulage adits driven at near the 700 ft and 300 ft levels.

The Ross-Adams ore body is underlain over much of its length by a body of aegirine syenite that, with the exception of a small exposure in the Ross-Adams pit, is only exposed in underground workings.
The ore body is also surrounded by a halo of aegirine-altered riebeckite granite.

The ore comprised a core of relatively higher-grade rock grading more than 0.5 pct U_3O_8 and an enveloping lower-grade zone containing less than 0.5 pct U_3O_8. Although not recovered, concentrations of thorium in the ore were generally greater than those of uranium. Sampling by MacKevett and later by Thompson, also indicated the ore contained approximately 100 ppm Cb as well as elevated concentrations of arsenic, titanium, zirconium, and heavy REE. Thompson reports that the ore was depleted in light REE, rubidium, and lithium, and had an enriched halo of columbium, yttrium, and zirconium mineralization surrounding the ore body.

Table 6. - Deposit types and prospects investigated.

Deposit Type	Prospect Name
Shear zones and fracture controlled deposits...........	Ross Adams
	Sunday Lake
	I and L No. 1 and
	Wennie
	Dotson Shear
	Other
Pegmatite deposits............	Northwestern Bokan Mountain including Boots prospect
	ILM and Bob Dick
	Little Jim
	Little Joe
	Irene-D
Dike Deposits.................	Geiger
	I and L
	Dotson
	Cheri
	Upper Cheri
	Upper Cheri Extension
	Shore
	Geoduck
Placer deposits..............	Kendrick Bay and South Arm Moira Sound



Compiled from Mackevett (3,5), Stephens (2), Thompson (8), and unpublished Bureau data

Figure 4 - Plan map and cross sections of the Ross Adams mine and ore body.

Mineralization consists dominantly of metamict uranothorite and uranoan thorianite with lesser coffinite in a gangue of quartz, feldspar, ferromagnesian minerals, hematite, chlorite, pyrite, fluorite, and galena. Minor concentrations of secondary uranium minerals, including gummite, sklodowskite, beta-uranophane, bassetite, and novacekite have also been identified (3). The mineralization is largely contained in microfractures, but locally is controlled by shear zones. Sulfide minerals, manganese oxides, and chlorite most often are associated with higher grade ore whereas hematite occurs with lower grade ore and peripheral to ore.

Sampling

Bureau sampling of the Ross-Adams deposit was confined to the open-pit where a series of channel samples were collected across a remnant of lower-grade ore (fig. 5), and to drill core from a few diamond drill holes that penetrate the body at depth (fig. 4 and tables 7-10). Samples collected in the pit indicate the "ore" contains only elevated values of uranium and thorium relative to the wall rock. No columbium-enriched halo in wall rock is apparent from Bureau sampling in the pit, although three samples of a dike of quartz latite to syenite composition adjacent to the ore average 240 ppm Cb.

In contrast, drill core samples indicate that syenite wall rock at depth is slightly enriched to 130 ppm Cb (d.h. [Standard Metals] KS-46 and KU-17), but drill hole intercepts of the ore zone contain less than 10 ppm Cb. Core samples (1-19, 1-20, and 1-21) indicate the ore zone is also relatively enriched with yttrium and other REE with values ranging up to 4,500 ppm Y and 789 ppm REE over 36 ft in drill hole KS-46. The ore zone averages 3,150 ppm Y and 735 ppm REE over 18 ft in the sampled drill holes (see also head assay in appendix C). Zirconium values, which average 0.24 pct in core samples from the ore zone, show no variations between ore and wall rock.

Resources

No additional resources were delineated by Bureau sampling, however, "probable" (defined as indicated in this report) reserves of 365,000 st containing approximately 1.24 MM lb U_3O_8 and 3.36 MM lb ThO_2 have been reported (16). Based on Bureau samples of drill core, (average 3,150 ppm Y, 735 ppm REE, and 0.24 pct Zr) a resource on the order of is indicated.

2,300,000 lb Y
537,000 lb REE
1,752,000 lb Zr

Columbium values in the ore and wall rock are too low to constitute a resource.

SUNDAY LAKE PROSPECT

General Description

The Sunday Lake prospect is located at approximately the 750-ft elevation on the northwest flank of Bokan Mountain (fig. 2). Workings consist of two short partially caved trenches and a small pit that expose the footwall portion of a

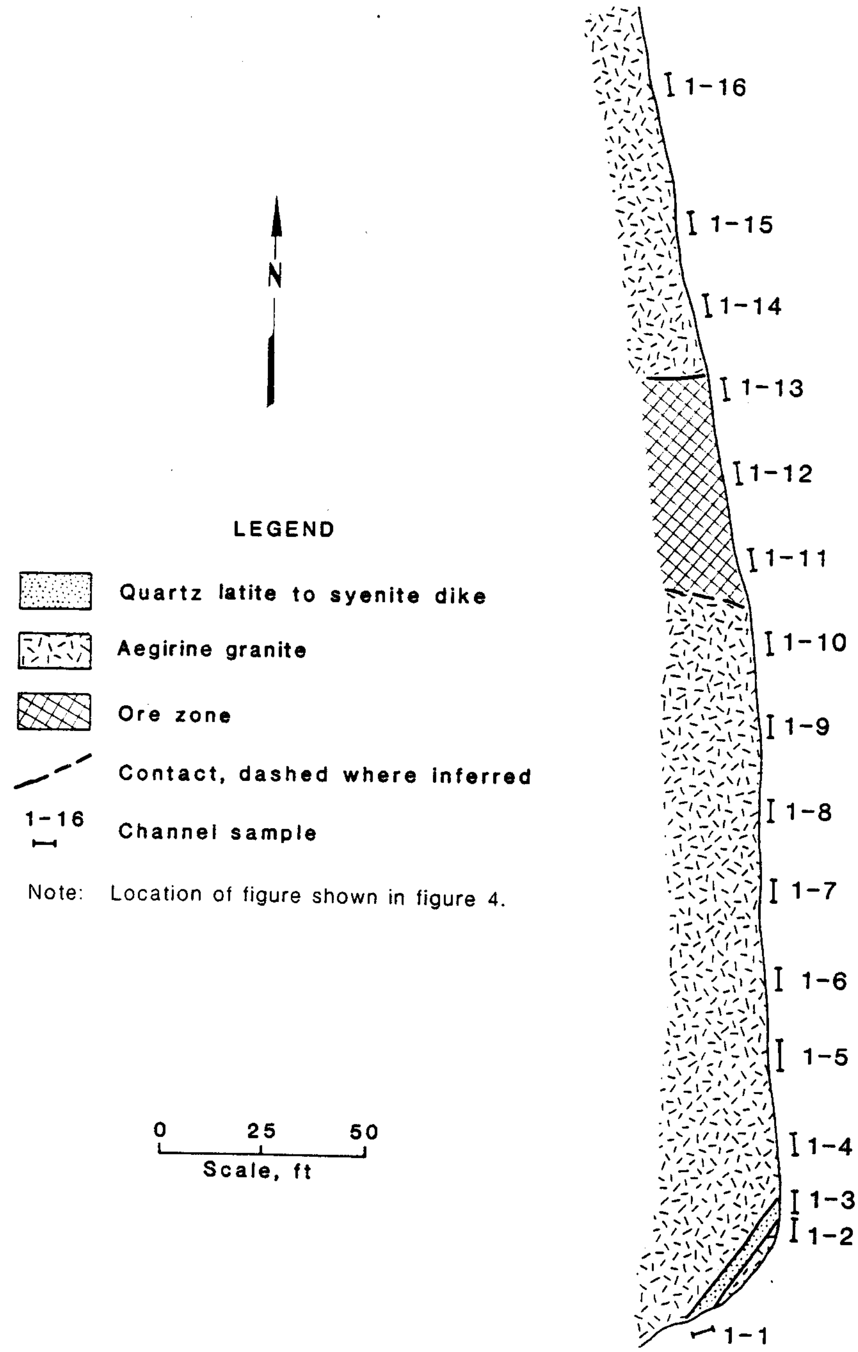


FIGURE 5- Locations of samples collected from the west wall of the Ross Adams pit.

TABLE 7. - Analyses[1] of samples collected at the Ross Adams mine.

Sample	Type	Width (ft)	Analyses, ppm except as noted: Cb	Th	U	Y	Zr pct	Rare-Earth-Elements: La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE 3/
1-1...	C	5.0	150	1040	3560	300	0.20	L	L	D	L	L	L	L	L	L	L	L	L	D	L	510
1-2...	Ch	3.0	290	350	120	100	0.01	L	L	L	L	L	L	L	L	L	L	L	L	20	L	20
1-3...	Ch	6.0	280	810	156	900	0.20	L	L	D	L	L	L	L	L	L	L	L	L	20	L	520
1-4...	Ch	6.0	130	370	72	100	0.03	200	L	L	L	L	L	L	L	L	L	L	L	50	L	250
1-5...	Ch	6.0	90	440	172	100	0.04	L	L	L	L	L	L	L	L	L	L	L	L	50	L	50
1-6...	Ch	6.0	L	2320	145	40	0.02	L	L	L	L	L	L	L	L	L	L	L	L	20	L	20
1-7...	Ch	6.0	50	1125	156	40	0.02	L	L	L	L	L	L	L	L	L	L	L	L	20	L	20
1-8...	Ch	6.0	85	430	92	100	0.05	L	L	L	L	L	L	L	L	L	L	L	L	50	L	50
1-9...	Ch	6.0	65	1030	45	100	0.02	L	L	L	L	L	L	L	L	L	L	L	L	50	L	50
1-10...	Ch	6.0	100	1125	86	100	0.04	L	L	L	L	L	L	L	L	L	L	L	L	100	L	100

Descriptions

Sample	Description
1-1...	Silicic and hematitic aegirine-bearing quartz-porphyry (syenite?) dike; 20,000 cps.
1-2...	Aegirine granite, minor fluorite.
1-3...	Quartz latite to syenite dike. Minor fluorite and some very smokey quartz. Dike is same as sample 1-1.
1-4...	Aegirine granite, aegirine replaces riebeckite; 6,000 cps.
1-5...	Aegirine granite; 14,000 cps.
1-6...	Aegirine granite; 15,000 cps. Minor chlorite on fractures.
1-7...	Aegirine granite; 15,000 cps. Minor chlorite on fractures.
1-8...	Aegirine granite; 10,000 cps. Moderate amount chlorite.
1-9...	Aegirine granite; 11,000 cps. Moderate amount chlorite and minor hematite alteration.
1-10...	Aegirine granite; 11,000 cps. Moderate amount chlorite and minor hematite alteration.

TABLE 7. - Analyses[1] of samples collected at the Ross Adams mine - cont.

Sample	Type	Width (ft)	Analyses, ppm except as noted: Cb	Th	U	Y	Zr pct	Rare-Earth-Elements: La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE 3/
1-11...	Ch	6.0	90	1040	550	100	0.10	L	L	L	L	L	L	L	L	L	L	L	L	100	L	100
1-12...	Ch	6.0	L	1270	1235	100	0.10	L	L	L	L	L	L	L	L	L	L	L	L	50	L	50
1-13...	Ch	6.0	100	1270	1020	100	0.05	L	L	L	L	L	L	L	L	L	L	L	L	50	L	50
1-14...	Ch	6.0	85	645	215	20	0.20	L	L	L	L	L	L	L	L	L	L	L	L	20	L	20
1-15...	Ch	6.0	65	60	15	20	0.06	L	L	L	L	L	L	L	L	L	L	L	L	D	L	10
1-16...	Ch	6.0	70	95	12	40	0.02	L	L	L	L	L	L	L	L	L	L	L	L	D	L	10
1-17[2]..	CR	12.0	120	84	17	470	0.38	113	253	-	96	26	3	-	-	-	-	-	-	50	8	549
1-18[2]..	CR	16.0	130	160	17	230	0.15	107	228	-	88	21	2	-	-	-	-	-	-	31	5	482
1-19[2]..	CR	15.0	L	590	448	8600	0.22	102	434	-	212	77	15	-	-	-	-	-	-	342	47	1229
1-20[2]..	CR	10.0	L	3000	99	960	0.29	74	273	-	91	60	9	-	-	-	-	-	-	52	11	570

Sample	Descriptions
1-11...	Aegirine granite; 20,000 cps. Pyrite replaced by hematite, abundant chlorite alteration.
1-12...	Pervasive chlorite alteration with moderate amount pyrite of aegirine granite; 20,000 cps.
1-13...	Pervasive chlorite alteration with moderate amount pyrite of aegirine granite; 20,000 cps.
1-14...	Chlorite-altered aegirine granite; 6,000 cps.
1-15...	Aegirine-riebeckite granite; 2,500 cps.
1-16...	Riebeckite-aegirine granite; 1,400 cps.
1-17...	See tables 8-10 for sample descriptions.
1-18...	See tables 8-10 for sample descriptions.
1-19...	See tables 8-10 for sample descriptions.
1-20...	See tables 8-10 for sample descriptions.

TABLE 7. - Analyses[1] of samples collected at the Ross Adams mine - cont.

Sample	Type	Width (ft)	Analyses, ppm except as noted: Cb	Th	U	Y	Zr pct	Rare-Earth-Elements: La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE [3]
1-21[2]..	CR	11.0	L	1400	102	2200	0.08	41	130	-	56	41	8	-	-	-	-	-	-	97	15	388
1-22[2]..	CR	14.5	50	24	1	200	0.24	5	10	-	L	1	L	-	-	-	-	-	-	2	.3	17
1-23[2]..	CR	10.0	L	540	767	60	0.25	77	230	-	155	78	1	-	-	-	-	-	-	31	7	579
1-24[2]..	CR	6.0	L	1100	17	90	0.24	138	59	-	56	43	1	-	-	-	-	-	-	26	I	323
1-25[2]..	CR	11.0	L	840	1200	60	0.28	125	262	-	154	37	1	-	-	-	-	-	-	35	19	623
1-26[2]..	CR	18.0	130	44	79	60	0.31	9	77	-	11	4	D	-	-	-	-	-	-	42	11	154
1-27[2]..	CR	7.5	L	3700	350	1200	0.18	164	257	-	70	58	7	-	-	-	-	-	-	71	15	642

C Channel sample. Ch Chip sample. CR Random chip sample. H High grade sample. D Detected. - Not analyzed.
L Less than detectable. I Interference.

[1]See table 4 for description of analytical methods, additional analyses presented in appendix.

[2]Analyzed at a commercial laboratory.

[3]Estimates of "Total REE" include detection limit "D" values for elements detected near limits of quantification. All 1986-1987 REE values are minimum-only due to self-shielding effect during neutron-activation analysis of samples with REE concentrates; 1986-1987 analyses also do not include values for Pr, Gd, Tb, Dy, Ho, Er, and Tm.

Sample	Descriptions
1-21...	See tables 8-10 for sample descriptions.
1-22...	See tables 8-10 for sample descriptions.
1-23...	See tables 8-10 for sample descriptions.
1-24...	See tables 8-10 for sample descriptions.
1-25...	See tables 8-10 for sample descriptions.
1-26...	See tables 8-10 for sample descriptions.
1-27...	See tables 8-10 for sample descriptions.

TABLE 8. - Partial log of Standard Metals diamond drill hole KS-46, Ross Adams mine. Bearing: 54° SW Inclination: -83° Total depth: 404.0 ft Size: NX

Sample	Interval, ft		Descriptions
	From	To	
1-17....	175.0	187.0	Aegirine granite. Moderate amount hematite spotting and local fluorite-rich zone.
1-18....	188.0	204.0	Aegirine granite, minor hematite staining and chlorite replacement of aegirine.
1-19....	205.0	220.0	205.0-206.0 Bleached and fractured aegirine granite; 206.5-209.5 Manganese- and chlorite-altered granite. Minor galena, hematite and uraninite(?); 210-220 Aegirine granite and syenite(?). Mixed iron- and manganese-oxides on fractures. This is Thompson's (8) "ore zone".
1-20....	220.0	230.0	Chlorite- and hematite-altered aegirine granite with mixed iron- and manganese-oxides on fractures. Continuation of "ore zone".
1-21....	230.5	241.5	Chlorite-altered aegirine granite with minor iron- and manganese-oxides on fractures and hematite staining. This is footwall to "ore zone".
1-22....	242.5	257.9	Aegirine (after riebeckite) granite. Unaltered except for minor oxides on fractures.

TABLE 9. - Partial log of Standard Metals diamond drill hole KU-17, Ross Adams mine. Bearing: S 45° E Inclination: approx. -45° Total depth: 76.0 ft Size: AX

Sample	Interval, ft		Descriptions
	From	To	
1-23....	20.0	30.0	Aegirine syenite, local chlorite staining, otherwise unaltered.
1-24....	30.0	36.0	Aegirine syenite, progressively more hematite downhole.
1-25....	36.0	47.0	36.0-42.5 hematite- and chlorite-altered syenite. Some disseminated galena and pyrite and possibly uraninite. 42.5-47.0 Blotchy hematite staining in aegirine syenite, minor specularite.
1-26....	47.0	65.0	Leucocratic syenite with local specularite and disseminated fluorite.

TABLE 10. - Partial log of Standard Metals diamond drill hole KS-60, Ross Adams mine. Bearing: N 89° W Inclination: -45° Total depth: 116.0 ft Size: NX

Sample	Interval, ft		Descriptions
	From	To	
1-27....	38.5	46.0	"Ore zone" of Thompson (8). 38.5-41.0 Chlorite-altered aegirine granite, some hematite, local pyrite or pyrrhotite. 41.0-46.0 Chlorite-altered granite or syenite, minor hematite.

north-northwest-trending, steeply dipping, radioactive shear zone in riebeckite granite. The hanging wall of the zone is covered by bog. The shear zone can be discontinuously traced for approximately 300 ft. Coincident air photo linears suggest the shear may extend farther to the northwest, however, no evidence of shearing was observed in outcrops on strike in either direction.

Where partially exposed in trenches 1 and 2 (fig. 6), the shear zone has minimum widths of 3 ft and 7 ft, respectively. The shear zone comprises highly radioactive (up to 29,000 cps) mottled red and black hematite-, limonite-, and manganese-stained earthy gouge and crushed quartz, feldspar(?), and galena fragments. A dense, buff-colored carbonate mineral was also observed and allanite is abundant within the shear zone where exposed in trench 2. Wall rock in the footwall of the shear zone consists of a 1- to 2-ft-wide shear zone of limonite-stained fractured granite.

Sampling

Channel samples of radioactive fault gouge collected from trenches 1 and 2 contain elevated to highly anomalous concentrations of thorium, uranium, yttrium, columbium, REE, and zirconium (table 11) as well as beryllium, lead, zinc, strontium, and titanium (appendix B). Channel samples of the shear zone in trench 1 average 380 ppm Cb, 5,200 ppm Th, 380 ppm U, 2.7 pct Y, and 3,500 ppm REE, but only traces of zirconium over a total length of 3.3 ft. A high-graded galena-rich sample (2-2) collected from an adjacent dump contained 9 ppm Ag, 4,500 ppm U, and 3.68 pct Th as well as 580 ppm Cb. Two channel samples (2-6, 2-7) of the shear zone in trench 2 (fig. 7) average 6,900 ppm U, 4.25 pct Th, 780 ppm Y, and 550 ppm Cb, 2,600 ppm REE, and 0.39 pct Zr over 8.5 ft. Lower, but anomalously high concentrations of uranium, thorium, columbium, and REE were also found in a float sample (2-1) collected 200 ft north of trench 1 indicating that mineralization likely continues to that point.

Resources

Resources are calculated at a grade and width equal to the average of the zone exposed in the two trenches (487 ppm Cb, 3.2 pct Th, 5,000 ppm U, 8,100 ppm Y, 0.28 pct Zr, and 2,800 ppm REE over 5.9 ft) and an estimated tonnage factor of 10 ft^3/st. Inferred resources over the entire 300 ft projection of the shear zone to a 150 ft depth are contained within 27,000 st of rock:

26,000 lb Cb	437,000 lb Y
1,728,000 lb Th	151,000 lb Zr
270,000 lb U	151,000 lb REE

I AND L NO. 1 AND WENNIE PROSPECTS

General Description

The I and L No. 1 and Wennie prospects are located near the 800-ft elevation on the western flank of Bokan Mountain (fig. 2). The prospects consist of northwest-trending manganese- and iron-oxide-stained shear zones within aegirine granite (fig. 7).

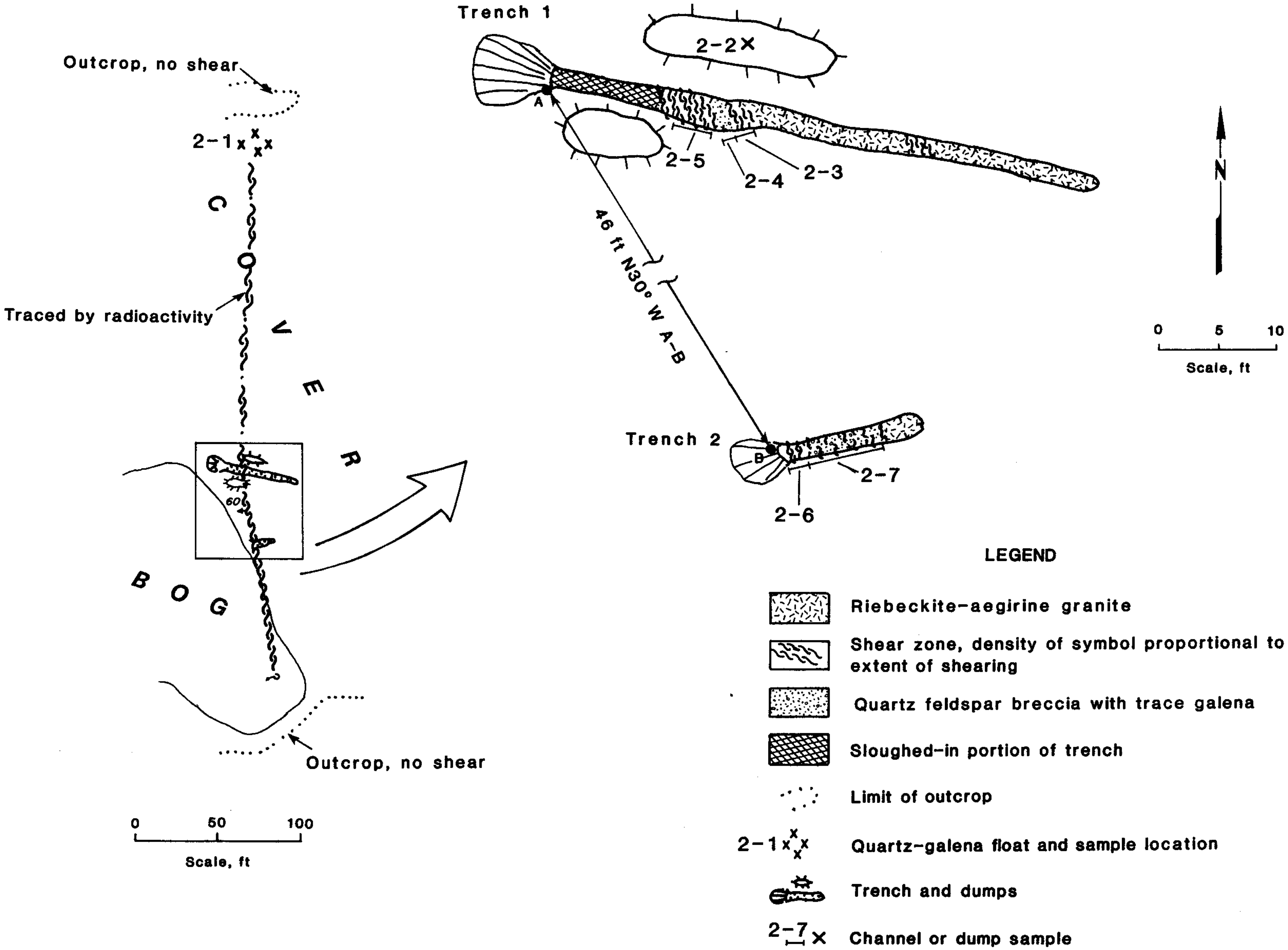


Figure 6 - Geologic and sample location map of the Sunday Lake prospect.

TABLE 11. - Analyses[1] of samples collected at the Sunday Lake prospect.

Sample	Type	Width (ft)	Analyses, ppm except as noted																			
							Zr	Rare-Earth-Elements														Total[2]
			Cb	Th	U	Y	pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	REE
2-1...	G	R	100	2690	320	600	0.03	40	D	L	5000	L	L	L	L	L	L	L	L	20	L	5600
2-2...	H	R	580	3.68%	4565	3000	0.20	90	D	L	L	L	L	L	L	L	L	L	L	D	L	700
2-3...	C	2.0	90	210	37	400	0.07	L	D	L	L	L	L	L	L	L	L	L	L	200	L	800
2-4...	C	0.8	620	275	17	2.0%	D	L	D	L	1000	L	D	L	L	L	L	L	L	1000	L	2700
2-5...	C	2.5	290	6800	500	3.0%	L	10	D	L	L	3000	D	L	L	L	L	L	L	1000	L	4710
2-6...	C	2.0	1240	12.8%	2.39%	2000	1.00	300	D	L	L	L	D	L	L	L	L	L	L	500	L	1500
2-7...	C	6.5	270	1.62	1633	400	0.20	90	D	L	3000	L	L	L	L	L	L	L	L	50	L	3740

C Channel sample. D Detected. G Grab sample. H High-graded sample. R Random sample. L Less than detectable.

[1]See table 4 for a description of analytical methods and appendix for additional analyses.

[2]Estimates of "Total REE" include detection limit "D" values for elements detected near limits of quantification.

Descriptions	
2-1...	Iron-stained quartz and feldspar vein(?) material with up to 1 pct disseminated and fracture-filling galena.
2-2...	Extremely radioactive iron-and manganese-stained breccia fragments of quartz-galena-allanite(?) from shear zone. Collected from dump.
2-3...	Sheared and limonite-stained riebeckite granite at footwall of shear zone.
2-4...	Limonite- and hematite-stained quartz breccia fragments in structurally lower portion of shear. Unidentified pink- to tan-colored dense mineral and galena also present.
2-5...	Mottled red, orange, black, and pink earthy gouge and angular rock fragments from structurally higher portion of steeply southwest-dipping shear zone. Extremely radioactive (to 24,000 cps).
2-6...	Extremely radioactive (to 29,000 cps) hematite-stained black waxy mineral (allanite?) with abundant galena and a non-calcareous carbonate mineral. Collected from structurally highest portion of shear zone exposed.
2-7...	Mottled hematite- and limonite-stained gouge with quartz and feldspar fragments in structurally lower portion of the shear.

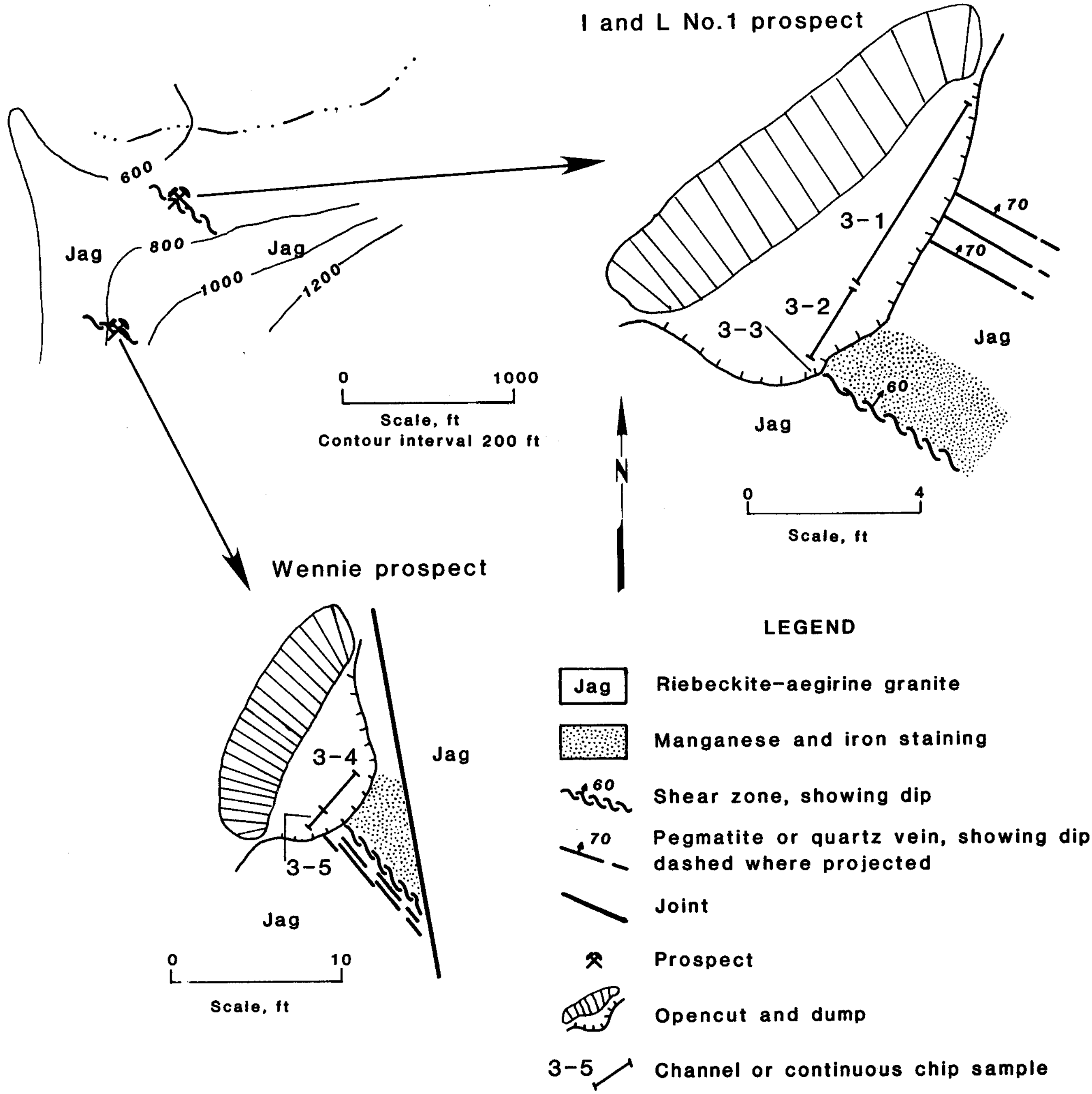


Figure 7 - Geologic and sample location map of the I and L No.'s 1 and 2 and Wennie prospect areas.

The I and L No. 1 prospect consists of a small open cut that exposes an altered N54°W-striking, 60°NE-dipping shear zone. An inch-thick zone of hematitic, pyritic, and manganese-rich fault gouge at this prospect is highly radioactive (12,000 cps), but radioactivity decreases to 600 cps 3 ft into the hanging wall of the zone. Approximately 4 ft from the shear zone, the hanging wall is cut by three small non-radioactive quartz-rich pegmatites.

The Wennie prospect is similar to the I and L No. 1 prospect. It consists of a small open cut that exposes a thin vertical N45°W-striking radioactive shear zone. This zone has a 2.5-ft-wide manganese- and hematite-stained and locally pyritic hanging wall and a footwall of thin quartz veins that cut the aegirine granite. The shear zone extends 8 ft southeast from the cut where it is truncated by a vertical N10°W-striking joint. The shear zone does not cut a bedrock exposure on strike 20 ft to the northwest.

Sampling

Sampling indicates that iron- and manganese-stained shear zones and radioactive fault gouge in the I and L No. 1 and Wennie prospect area are enriched in radioactive elements, especially thorium (table 12). The shear zones also contain minor enrichment of columbium, with a high value of 400 ppm as well as enrichment in the heavy REE.

Resources

No resource estimates were made for these relatively small occurrences.

OTHER OCCURRENCES

Altered Peralkaline Granite

Numerous occurrences of altered aegirine or riebeckite granite containing elevated metal concentrations were located during the course of field work (fig 8). These occurrences invariably contain faint to persistent hematite and chlorite alteration, usually of aegirine or riebeckite, and exhibit radioactivity up to several times background. Hematite alteration of the albite-quartz groundmass most often occurs as spots. Alteration zones range in size from a few tens of feet across to larger areas of 50 to 100-ft-wide and several times as long.

Six samples composed of numerous random chips of hematite-altered peralkaline granite contained trace-element values approximately 50 to 100 pct greater than background metal concentrations in the peralkaline granite (compare table 3 with table 13). Yttrium, zirconium, and REE values in the samples are comparable to their respective background values.

TABLE 12. - Analyses[1] of samples collected at the I and L No. 1 and Wennie prospects.

Sample	Type	Width (ft)	Analyses, ppm except as noted: Cb	Th	U	Y	Zr pct	Rare-Earth-Elements: La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE[2]
3-1...	Ch	9.0	70	65	12	100	0.10	D	D	D	L	L	L	L	L	L	D	L	L	D	L	1730
3-2...	Ch	2.0	L	435	19	100	0.04	L	D	D	L	L	L	L	L	D	D	L	D	100	L	2220
3-3...	H		240	18200	13	100	0.03	40	D	D	D	L	L	100	L	800	D	400	40	100	L	3880
3-4...	C	2.7	400	2645	42	D	0.10	D	D	D	L	L	L	500	L	3000	500	2000	100	1000	L	8720
3-5...	C	.4	140	450	17	100	0.03	D	D	D	L	L	200	200	L	2000	D	800	60	500	D	5580

Ch Chip sample. C Channel sample. D Detected. H High-graded sample. L Less than detectable.

[1]See table 4 for description of analytical methods and appendix for additional analyses.

[2]Estimates of "total REE" include detection limit "D" values for elements detected near limits of quantification.

Sample	Descriptions
3-1...	Locally manganese- or iron-stained aegirine granite cut by a few thin pegmatite dikes; 600 cps.
3-2...	Discontinuously fractured or sheared aegirine granite with local manganese and pyrite on fractures and local pervasive hematite staining. Hanging wall of fault; 2,500 cps.
3-3...	Hematite- and manganese-stained 0.1-ft-wide fault gouge zone; 1,200 cps.
3-4...	Manganese- and hematite-stained sheared aegirine granite adjacent to fault. Zone is more hematite- and pyrite-rich towards fault; 10,000 cps.
3-5...	Aegirine granite cut by numerous thin quartz veinlets. Footwall of fault; 3,400 cps.

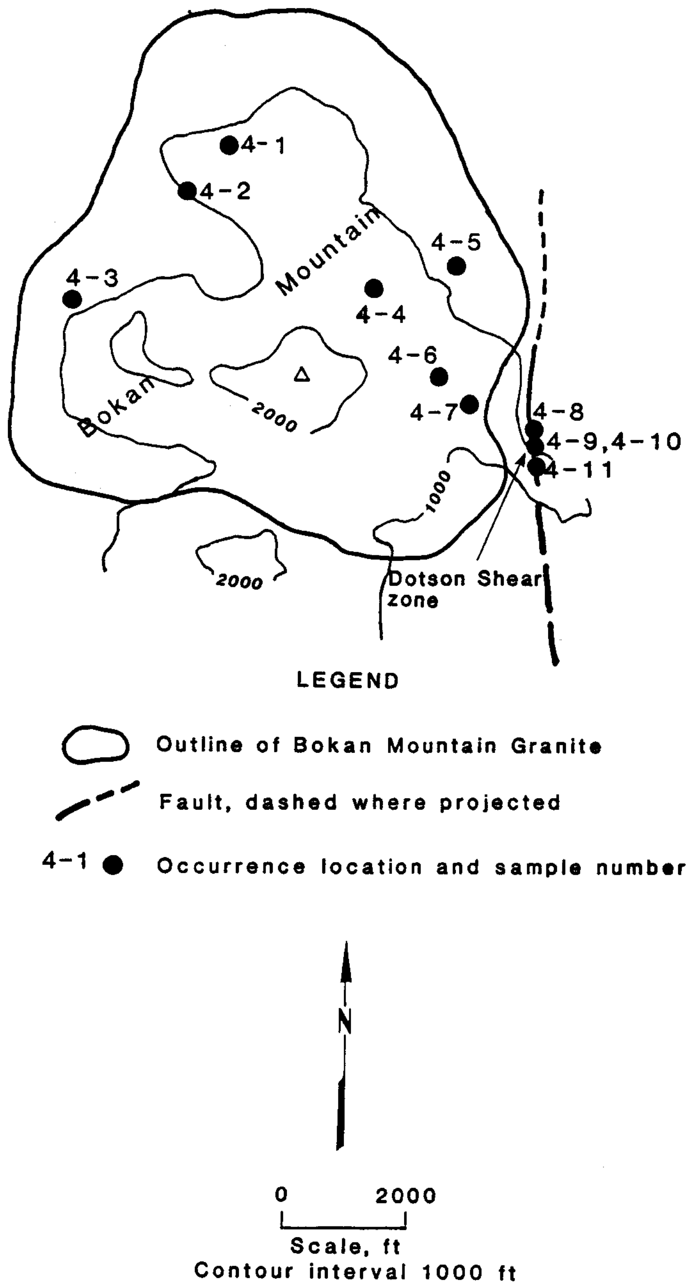


Figure 8 - Other occurrences of shear zone and fracture-controlled mineralization.

TABLE 13. - Analyses[1] of samples collected from other occurrences of shear zone or fracture-controlled mineralization.

Sample	Type	Width (ft)	Analyses, ppm except as noted																			
								Rare-Earth-Elements														Total[3]
			Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	REE
4-1[2]..	R		80	45	18	360	0.18	127	267	-	112	25	3	-	-	-	-	-	-	29	4	567
4-2...	Ch	10.0	110	60	8	100	0.10	L	D	D	L	L	L	L	L	D	D	L	D	L	L	1220
4-3...	Ch	16.0	180	220	19	100	0.05	L	D	D	L	L	L	L	L	L	D	L	L	50	L	1150
4-4...	R		170	L	16	40	0.07	L	D	D	L	L	L	L	L	L	L	L	L	L	L	1000
4-5[2]..	R		120	L	5	200	0.09	L	D	D	L	L	L	L	L	L	L	L	L	50	L	1050
4-6[2]..	R		110	25	26	220	0.38	103	229	-	101	24	3	-	-	-	-	-	-	26	4	490
4-7[2]..	R		90	39	20	120	0.18	104	238	-	85	14	1	-	-	-	-	-	-	21	3	466
4-8...	C	3.0	L	35	L	L	L	L	L	L	L	L	L	L	-	L	L	L	L	L	L	L
4-9...	C	6.0	67	550	85	20	L	L	L	L	L	L	L	L	-	L	L	L	L	D	L	10
4-10..	C	4.0	62	510	265	20	0.01	L	L	L	L	L	L	L	-	L	L	L	L	D	L	10
4-11..	C	3.0	L	L	10	D	0.01	L	L	L	L	L	L	L	-	L	L	L	L	D	L	10

Ch Chip sample. D Detected. - Not analyzed. NAp - Not applicable. R Random sample. L Less than detectable.

[1]See table 4 for description of analytical methods and appendix for additional analyses.

[2]Analyzed at a commercial laboratory.

[3]Estimates of "Total REE" includes detection limit "D" values for elements detected near limits of quantification. All 1986-1987 REE values are minimum-only due to self-shielding effect during neutron-activation analysis of samples with REE concentrates; 1986-1987 analyses also do not include values for Pr, Gd, Tb, Dy, Ho, Er, and Tm.

Descriptions	
4-1...	Shear zone.
4-2...	Aegirine-riebeckite granite with minor spotty hematite staining; 400 - 500 cps.
4-3...	Aegirine granite with minor riebeckite and spotty hematite staining; 900 - 1,900 cps.
4-4...	Porphyritic riebeckite granite with minor replacement aegirine; 600 cps.
4-5...	Aegirine aplite with minor spotty hematite.
4-6...	Fine-grained reibeckite granite with minor replacement aegirine and local hematite spotting; 300 cps.
4-7...	Fine-grained equigranular riebeckite granite with minor replacement aegirine; 600 cps.
4-8...	Highly altered and sheared quartz monzonite(?) along northeast-trending shear; 5,000 cps.
4-9...	Alternating bands of white argillically altered crushed granite (?) and sheared quartz monzonite; 1,700-15,600 cps.
4-10..	Continuation of sample 4-9 to north.
4-11..	Chlorite-altered argillic shear zone, very weathered; 275 cps.

Dotson Shear Zone

A relatively wide northeast-trending fault zone composed of sheared and crushed andesite and quartz monzonite is exposed near the mine road a few hundred feet south of the Bokan Mountain granite contact (fig. 8). Where exposed in the road cut and in pits excavated along strike in both directions, the shear zone is 10 ft or more in width, and shows locally very high radioactivity (12,000 cps). Local prospectors report high grade pods of uranium mineralization with up to 5 pct U. The zone is also intruded by a pegmatitic felsic dike with anomalous beryllium and yttrium in at least one locality east of the mine road (see location under Irene-D prospect description). Coincident aerial photo linears suggest the shear zone is a regional fault extending at least several thousand feet along strike. An offset of at least 400 ft is indicated by the displacement of the I and L dikes from those of the Dotson prospect.

Two samples collected from the shear zone south of the Bokan Mountain granite contained elevated thorium and uranium values, averaging 534 ppm Th and 157 ppm U over 10 ft.

Resources

The occurrences of radioactive altered granite are too low-grade to be considered resources. Bureau surface sampling of the Dotson shear zone found only sporadic mineralization which does not indicate a significant resource.

*** PEGMATITE DEPOSITS

Five prospects are included under the category of pegmatite deposits. Pegmatites are moderately common throughout the peralkaline granite and range from being short lensoidal bodies to elongated convoluted sheets or pods. They can be subdivided into two groups; those that cut the aegirine-riebeckite complex, e.g. the ILM, and those pegmatite zones or dikes associated with the border zone pegmatite phase, e.g. the Irene-D. Most exhibit complex mineralogies including quartz, albite, aegirine, zircon, and variable amounts of allanite, ilmenite, riebeckite, arsenopyrite, fluorite, and numerous other minerals. Pegmatites of the border zone pegmatite zone commonly contain disseminated spinels of iron and titanium, and magnetite also occurs as an apparent alteration of riebeckite. Massive milky white quartz forms the core of pegmatites. The trace-element composition of the pegmatites is likewise complex and may include elevated quantities of gold, beryllium, columbium, REE, hafnium, lithium, tantalum, tin, thorium, uranium, yttrium, and zirconium. To variable degrees these elements also occur in a wall rock enrichment halo to the pegmatites. Commonly, the wall rocks exhibit aegirine, sericite, and hematite alteration and feldspars altered to clay minerals.

NORTHWESTERN BOKAN MOUNTAIN AREA

General Description

Numerous relatively small and pod-like radioactive pegmatite dikes along with aplite dikes and generally non-radioactive quartz veins, are present between the 700 and 1,100-ft elevations of the north-western flank of Bokan Mountain (fig. 9). These occurrences include the "Boots" prospect briefly described by MacKevett (3), as well as several previously undescribed pegmatite occurrences.

Pegmatites in this area are hosted by shales and marls, quartz monzonite, riebeckite granite, and by a tongue of locally biotite-bearing aplite that extends from within the granite approximately 4,000 ft to the north into the sedimentary country rocks. The pegmatite dikes generally strike northwest, are narrow, ranging from 0.2 to 2.0-ft-wide and are individually traceable for up to 150 ft. Most pegmatites are complex, consisting of variable amounts of amphibole, biotite, magnetite, zircon, quartz, feldspar, pyrite, fluorite, and radioactive minerals. Simple quartz-rich pegmatites, however, are also present, and together with quartz veins occur both singularly and in closely-spaced sheeted zones.

Sampling

Samples contain minor to moderately high concentrations of uranium, thorium, columbium, REE, yttrium, zinc, and lead (table 14). Very anomalous concentrations of zirconium and hafnium are also present in several samples (to 9.7 pct Zr and 1,600 ppm Hf, sample 5-8). A sample (5-10) of a 0.5-ft-wide quartz-pyrite dike with visible gold contained 71.5 ppm (1.8 t oz/st) Au and 22.5 ppm (0.8 t oz/st) Ag. This vein was traceable along strike for only 20 ft.

Resources

These small occurrences, to the extent evaluated, do not represent a significant resource. Areas of closely-spaced sheeted zones may contain some low-grade metal values.

ILM PROSPECTS

General Description

The ILM prospects, including claims known as the Bob Dick property and other nearby mineral showings (3), consist of northwest-trending series of radioactive (to 2,000 cps) pegmatites located on the east ridge to the summit of Bokan Mountain (fig. 10). Pegmatites outcrop at an elevation of 1,350 ft and can be traced intermittently along a N30°-50°W strike to the summit of the mountain. The prospects were discovered in 1955 and minor hand trenching and sampling was done shortly thereafter. Due to the relatively low uranium values, there has been little or no further exploration in more recent years.

The structure of the pegmatites is complex and is suggestive of emplacement while the intrusive complex was still a partially molten and flowing mass. Individual pegmatite lenses pinch and swell from widths of a few inches

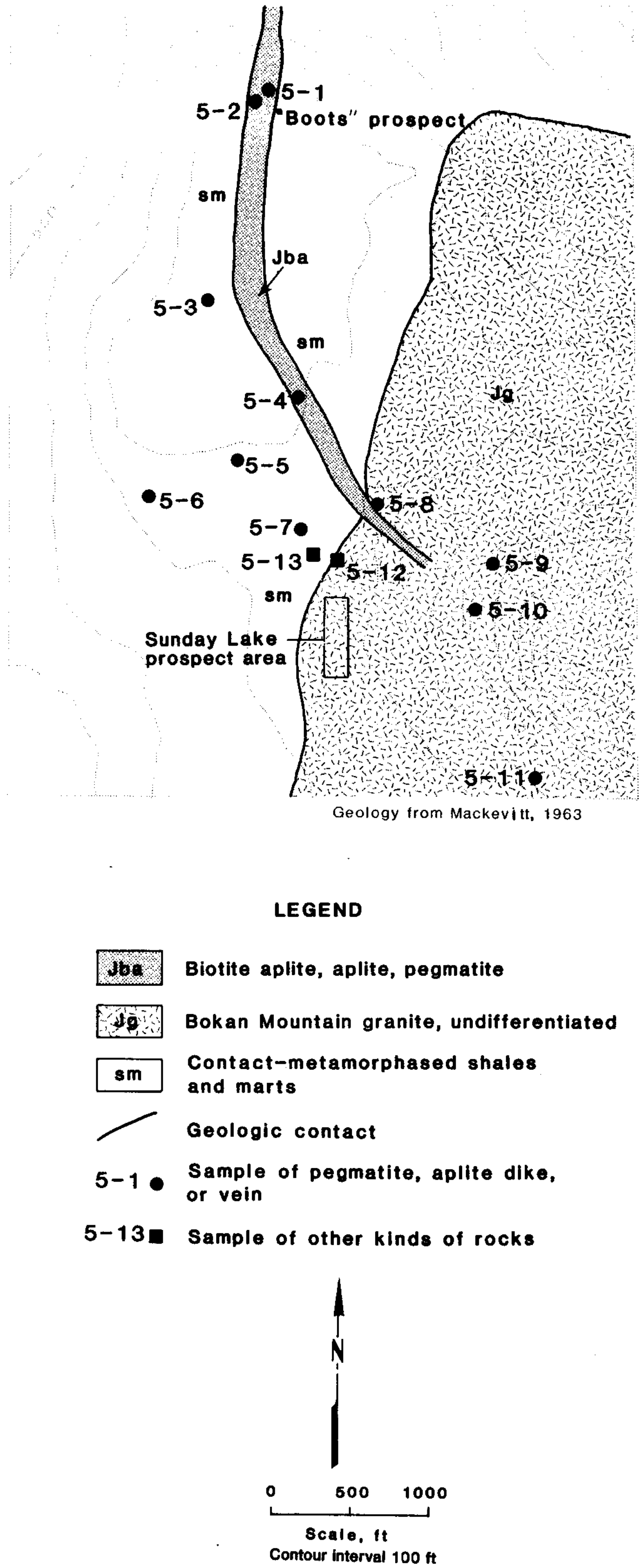


Figure 9 - Geologic and sample location map of the northwestern Bokan Mountain area.

TABLE 14. - Analyses[1] of samples collected from northwestern Bokan Mountain.

Sample	Type	Width (ft)	Analyses, ppm except as noted																			[2] Total REE
								Rare-Earth-Elements														
			Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	
5-1...	C	0.5	500	135	88	70	0.15	300	L	D	3000	L	L	200	L	L	L	L	L	20	L	4120
5-2...	C	3.0	500	270	83	200	0.20	90	L	D	3000	L	L	500	L	L	L	800	D	20	L	4930
5-3...	H		600	592	103	400	3.20	40	D	D	L	L	L	L	L	D	L	100	D	100	L	1460
5-4...	Ch	1.0	1600	965	144	2000	5.90	L	L	D	1000	L	L	L	L	D	L	L	L	L	L	1700
5-5...	Ch	0.7	80	55	17	40	L	L	L	D	L	L	L	L	L	L	D	L	L	L	L	700
5-6...	Ch	0.2	450	80	21	300	1.30	200	L	D	D	L	L	L	L	L	D	L	L	50	L	1500
5-7...	Ch	1.2	L	L	2	D	L	L	L	D	L	L	L	L	L	L	D	L	L	L	L	650
5-8...	CR		L	875	194	600	9.70	90	L	D	2000	L	L	L	L	L	L	200	40	500	L	3480
5-9...	Ch	0.1	L	60	28	D	0.08	L	D	D	L	L	L	L	L	D	L	L	L	20	L	1220
5-10..	Ch	0.5	110	80	13	200	0.06	L	D	D	L	L	L	L	L	D	D	L	L	L	L	1250

Descriptions

5-1...	Pegmatite of Boots Prospect with core of pyritic quartz and selvage of coarse quartz and feldspar; 740 cps.
5-2...	Pyritic muscovite aplite. Zone of higher radioactivity (to 1,900 cps) traceable for a total strike length of 75 ft along Boots Prospect.
5-3...	High-grade of central portion of 5-ft-wide pyritic aplite dike. Unidentified resinous brown-black minerals disseminated in groundmass; 100 cps.
5-4...	Quartz-aegirine pegmatite with minor xenotime and possible uraninite; 4,100 cps.
5-5...	Siliceous and pyritic aplite dike; 250 cps.
5-6...	Complex vein-pegmatite containing coarse quartz, a flat blade-like black mineral, pink-colored minerals, and pale yellow-colored minerals. Traced for 150 ft by radioactivity (250 cps).
5-7...	Iron-stained quartz-feldspar-biotite(?) pegmatite with aplitic selvages; 200 cps.
5-8...	Random chips from 5 of several criss-crossing pegmatites in this area.
5-9...	Iron- and manganese-stained milky white quartz vein; 250 cps.
5-10..	0.5-ft-wide quartz pyrite vein with minor amber- and black-colored minerals in slightly sheared, hematite- and manganese-stained, fluorite-bearing granite. A flake gold observed. Vein traceable for 20 ft; 650 cps.

TABLE 14. - Analyses[1] of samples collected from northwestern Bokan Mountain - continued.

Sample	Type	Width (ft)	Analyses, ppm except as noted																				[2]
								Rare-Earth-Elements															Total
			Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	REE	
5-11...	H	0.2	150	2575	46	600	0.20	L	D	D	L	L	L	L	L	800	D	200	40	200	L	2390	
5-12...	Ch	R	L	L	6	D	L	L	L	D	L	L	L	L	L	L	L	L	L	L	L	600	
5-13...	Ch	R	60	205	1095	20	L	L	L	D	L	L	L	L	L	L	L	L	L	L	L	L	

C Channel sample. Ch Chip sample. D Detected. G Grab sample. H Highgraded sample. CR Random chip sample. L Less than detectable.

[1]See table 4 for description of analytical methods.

[2]Estimates of "Total REE" include detection limit "D" values for elements detected near limits of quantification.

Descriptions	
5-11...	Quartz-fluorite-pyrite pocket in irregular pegmatite; 3,200 cps.
5-12...	Goethite-limonite fragments in rubble near hornfels. Probably represents iron-rich seep.
5-13...	Manganese- and limonite-stained, pyrrhotite-bearing hornfels and chert.

TABLE 14. - Analyses[1] of samples collected from northwestern Bokan Mountain - continued.

Sample	Type	Width (ft)	Analyses, ppm except as noted[2]																			
								Rare-Earth-Elements														Total
			Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	REE
5-11...	H	0.2	150	2575	46	600	0.20	L	D	D	L	L	L	L	L	800	D	200	40	200	L	2390
5-12...	Ch	R	L	L	6	D	L	L	L	D	L	L	L	L	L	L	L	L	L	L	L	600
5-13...	Ch	R	60	205	1095	20	L	L	L	D	L	L	L	L	L	L	L	L	L	L	L	L

C Channel sample. Ch Chip sample. D Detected. G Grab sample. H Highgraded sample. CR Random chip sample. L Less than detectable.

[1]See table 4 for description of analytical methods.

[2]Estimates of "Total REE" include detection limit "D" values for elements detected near limits of quantification.

Descriptions	
5-11...	Quartz-fluorite-pyrite pocket in irregular pegmatite; 3,200 cps.
5-12...	Goethite-limonite fragments in rubble near hornfels. Probably represents iron-rich seep.
5-13...	Manganese- and limonite-stained, pyrrhotite-bearing hornfels and chert.

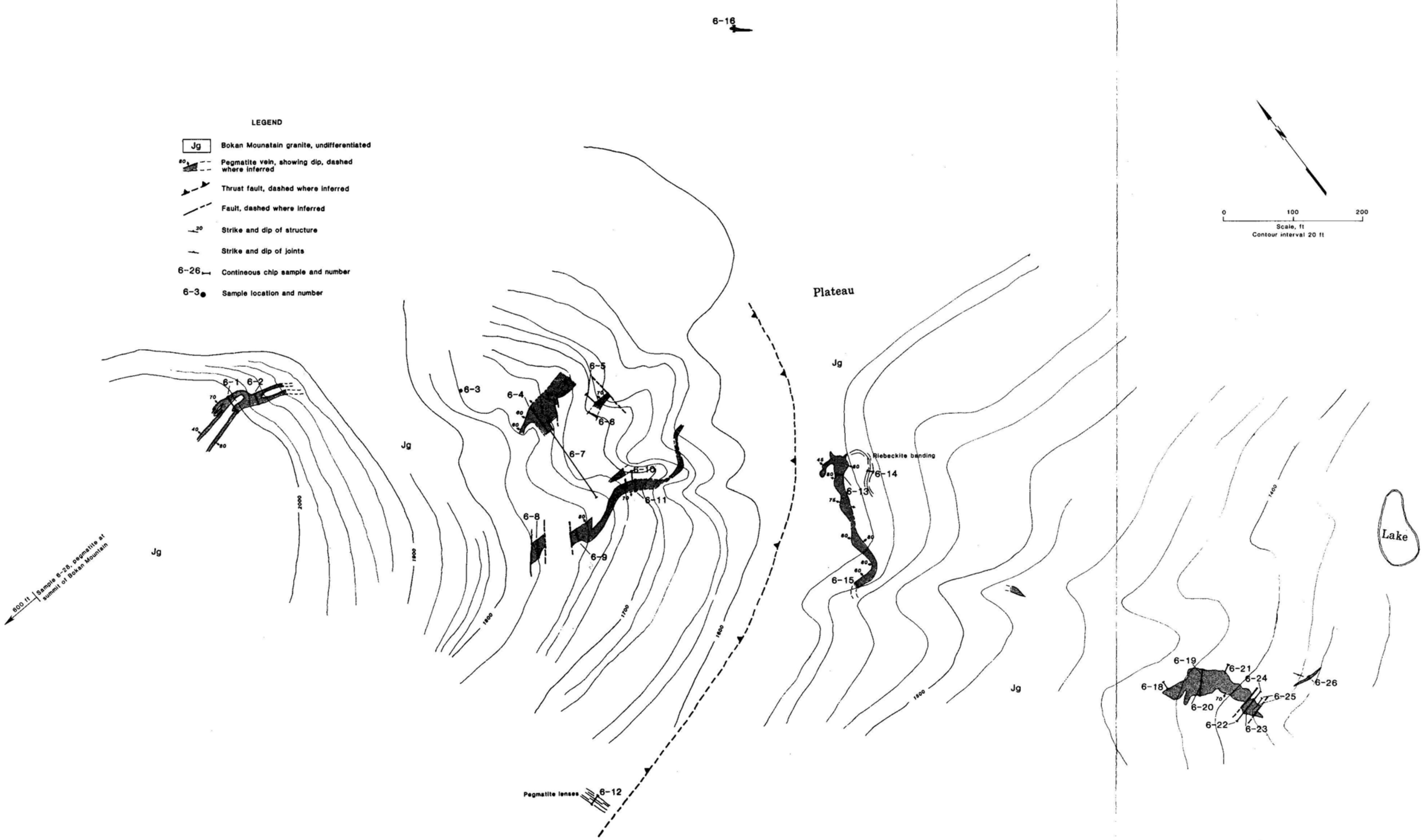


Figure 10 - Geologic and sample location map of the ILM prospect.

TABLE 15. - Analyses[1] of samples collected at the ILM prospect.

Sample	Type	Width (ft)	Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE
			Analyses, ppm except as noted					Rare-Earth-Elements														3/
6-1[2]..	Ch	40.0	240	80	67	550	1.30	170	370	-	150	30	D	-	-	-	-	-	-	90	10	820
6-2[2]..	Ch	5.0	410	63	89	770	2.80	810	1410	-	710	110	10	-	-	-	-	-	-	120	20	3190
6-3[2]..	Ch	12.0	40	10	5	30	0.05	30	60	-	20	D	-	-	-	-	-	-	-	D	D	110
6-4...	Ch	30.0	1380	135	140	200	2.00	400	D	D	D	L	L	200	L	D	D	L	D	100	L	3520
6-5...	Ch	6.0	80	45	5	4000	0.01	L	100	D	L	L	L	L	L	D	L	L	L	L	L	1500
6-6...	Ch	12.0	6000	255	534	2000	3.00	300	L	D	D	L	L	200	L	L	D	L	D	100	L	2420
6-7...	Ch	100.0	60	L	5	20	0.01	L	D	D	L	L	L	L	L	L	D	D	L	L	L	1800
6-8...	Ch	6.0	1160	160	37	40	3.00	90	L	D	D	L	L	L	L	L	D	200	L	100	L	2190
6-9...	Ch	12.0	950	335	78	200	2.30	400	L	D	D	L	L	L	L	D	D	D	D	200	L	2920
6-10[2].	Ch	8.0	70	18	8	80	0.07	20	80	-	20	D	D	-	-	-	-	-	-	30	D	150

Descriptions	
6-1...	Up to 2-ft-wide pegmatite band and intervening aegirine-hematite-clay-altered granite.
6-2...	Pegmatite.
6-3...	Porphyritic riebeckite granite wall rock with hematite spotting.
6-4...	Largest pegmatite exposure, equigranular K-feldspar and lessor quartz, minor hematite staining.
6-5...	Riebeckite granite hanging wall to pegmatite.
6-6...	Pegmatite with 1.3-ft-wide quartz core, boxwork common.
6-7...	Riebeckite granite overlaying pegmatite zone.
6-8...	Hematite-stained equigranular pegmatite.
6-9...	Pegmatite zone with 1.2-ft-wide massive quartz core.
6-10..	Medium-grained clay- and hematite-altered aegirine-riebeckite granite footwall to pegmatite.

TABLE 15. - Analyses[1] of samples collected at the ILM prospect - continued.

Sample	Type	Width (ft)	Analyses, ppm except as noted[3]																			
								Rare-Earth-Elements														Total
			Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	REE
6-11..	Ch	10.0	1900	365	314	200	2.10	900	L	D	2000	L	L	300	L	L	D	400	D	200	L	4920
6-12[2].	Ch	20.0	420	81	71	820	1.00	190	550	-	230	60	D	-	-	-	-	-	-	120	20	1170
6-13..	Ch	5.0	950	1215	500	2000	6.00	400	D	D	3000	L	L	L	L	800	D	800	D	500	L	7720
6-14[2].	Ch	4.0	I	17	15	I	I	60	120	-	30	D	D	-	-	-	-	-	-	30	D	240
6-15[2].	Ch	8.0	550	290	242	2300	3.10	880	1790	-	690	130	D	-	-	-	-	-	-	320	50	3860
6-16[2].	C	3.5	350	170	33	300	3.20	40	-	-	-	-	-	-	-	-	-	-	-	20	50	110
6-18[2].	Ch	10.0	90	24	12	150	0.19	150	320	-	120	20	D	-	-	-	-	-	-	30	D	640
6-19..	C	16.0	1010	180	10	200	4.40	200	D	D	D	L	L	L	L	800	D	D	D	200	L	3720
6-20..	Ch	19.0	240	95	6	400	3.00	40	L	D	D	L	L	L	L	D	D	D	D	200	L	2560
6-21[2].	Ch	10.0	60	25	11	80	0.12	40	100	-	20	D	D	-	-	-	-	-	-	20	D	180

Sample	Descriptions
6-11..	Pegmatite with large knots of aegirine.
6-12..	Series of N70W striking pegmatites up to 2 ft thick.
6-13..	Pegmatite.
6-14..	4-ft-wide zone of riebeckite banding in granite.
6-15..	Pegmatite.
6-16..	Pegmatite with poddy quartz masses up to .5 ft thick.
6-18..	Hematitic aegirine-riebeckite granite footwall to pegmatite.
6-19..	Very coarse-grained pegmatite with 3-ft-wide quartz core and grey metallic pods.
6-20..	Pegmatite with 40 pct massive quartz and minor green fluorite.
6-21..	Riebeckite partially altered to aegirine in wall rock of pegmatite.

TABLE 15. - Analyses[1] of samples collected at the ILM prospect - continued.

Sample	Type	Width (ft)	Analyses, ppm except as noted																			
								Rare-Earth-Elements														Total REE[3]
			Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	
6-22..	Ch	9.0	280	55	14	100	0.30	L	L	D	L	L	L	L	L	L	L	L	L	D	L	1010
6-23..	Ch	17.1	3100	495	288	900	3.00	2000	1000	D	3000	L	L	L	L	D	D	D	D	200	L	7820
6-24..	Ch	8.0	410	145	65	1000	1.10	200	D	D	D	L	L	L	L	800	D	D	D	200	L	3720
6-25[2].	C	12	120	33	20	150	0.19	150	320	-	120	20	D	-	-	-	-	-	-	20	D	640
6-26[2].	Ch	4.0	580	45	93	510	5.50	240	580	-	190	40	D	-	-	-	-	-	-	240	40	1330
6-27[2].	Ch	4.0	620	85	83	870	1.80	400	910	-	450	80	D	-	-	-	-	-	-	120	20	1980

C Channel sample. Ch Chip sample. D Detected. I Not determined due to interferance. - Not analyzed. L Not detected.
R Random sample.
[1]See table 4 for analytical methods and detection limits, additional analyses presented in appendix.
[2]Analyzed at a commercial laboratory.
[3]Estimates of "Total REE" includes detection limit "D" values for elements detected near limits of quantification. All 1986-1987 REE values are minimum-only due to self-shielding effect during neutron-activation analysis of samples with REE concentrates; 1986-1987 analyses also do not include values for Pr, Gd, Tb, Dy, Ho, Er, and Tm.

Sample	Descriptions
6-22..	Riebeckite granite hanging wall to pegmatite.
6-23..	More radioactive portion of sample.
6-24..	Aegirine-altered riebeckite granite footwall to pegmatite.
6-25..	Aegirine-riebeckite wall rock to pegmatite.
6-26..	Narrow west-striking pegmatite up to 4 ft thick.
6-27..	Pegmatite striking southeast across summit of Bokan Mountain, dips vertical and exposed for 50 ft. Sample includes 1 ft of wall rock on each side of contact.

Resources

Due to the complex shape of the ILM pegmatites it is not possible to accurately calculate indicated resource tonnages without extensive subsurface exploration. However, it is apparent that a definable zone of sinuous pegmatitic lenses extends along a strike of at about 1,500 ft and a vertical exposure of about 700 ft. Inferred estimates of tonnage potential can be made from a variety of criteria. For this project an inferred tonnage estimate is made on the basis of: 1) 1,000 ft of strike length (composited measured strike lengths from available exposures), 2) 500 ft of depth (representing one-half of the composited strike exposures), 3) an average thickness of 13.25 ft (average of measured and sampled pegmatite exposures), and 4) a tonnage factor of 11.3 (table 5). From the above criteria 586,000 st of rock is inferred to contain:

1,054,000 lb Cb	20,200,000 lb Zr
115,000 lb U	2,749,000 lb REE
732,000 lb Y	

LITTLE JIM PROSPECT

General Description

The Little Jim prospect is located at the 1,690-ft elevation on the northeastern ridge of Bokan Mountain. The prospect is very similar in occurrence, size, and mineralogy to the Little Joe prospect discussed in the next section. The principal showing lies about 200 ft west of a small, but prominent saddle in the ridge and consists of a west-northwest-trending 5- by 15-ft-wide zone of radioactive pegmatite pods in altered riebeckite granite. A fine-grained aegirine granite dike cuts the pegmatite and a set of joints and shears parallels the zone on the southwest side.

Sampling

Two channel samples were collected end to end across the 5-ft-wide mid-point of the pegmatite zone (table 16). Sample 7-1 is a 2 ft channel of the northeast side of the zone and sample 7-2 crosses the remaining 3 ft on the southwest side. Although columbium values up to 2,900 ppm were found, there was only minor enrichment of uranium, thorium, REE, and yttrium.

Resources

No resource calculations were made for this small occurrence.

LITTLE JOE PROSPECT

General Description

The Little Joe prospect is located at the 1,400-ft elevation on the northeastern flank of Bokan Mountain (fig. 2 and 11). The prospect comprises several minor radioactive showings that were briefly visited, but were not sampled by MacKevett (3).

TABLE 16. - Analyses[1] of samples collected at the Little Jim prospect.

Sample	Type	Width (ft)	Analyses, ppm except as noted																			
								Rare-Earth-Elements														Total
			Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	REE
7-1....	C	2.0	2900	1500	583	900	-	L	L	L	100	L	L	L	L	D	L	400	L	500	-	1100
7-2....	C	3.0	620	275	64	400	-	L	L	L	D	L	L	L	L	L	L	L	L	100	-	700
7-3....	C		230	105	13	400	-	L	D	L	D	L	L	L	L	L	L	L	L	100	-	1200

Ch Chip sample. C Channel sample. G Grab sample. H High grade sample. - Not analyzed. D Detected. L Less than detection limit. M Major concentration detected.

[1]See table 4 for description of analytical methods and appendix for additional analyses.

	Descriptions
7-1....	Radioactive pegmatite pod and hematite-altered riebeckite granite; 1,000 cps.
7-2....	Pervasively jointed radioactive iron-stained granite.
7-3....	Fine-grained banded riebeckite granite dike (?) paralleling pegmatite zone.

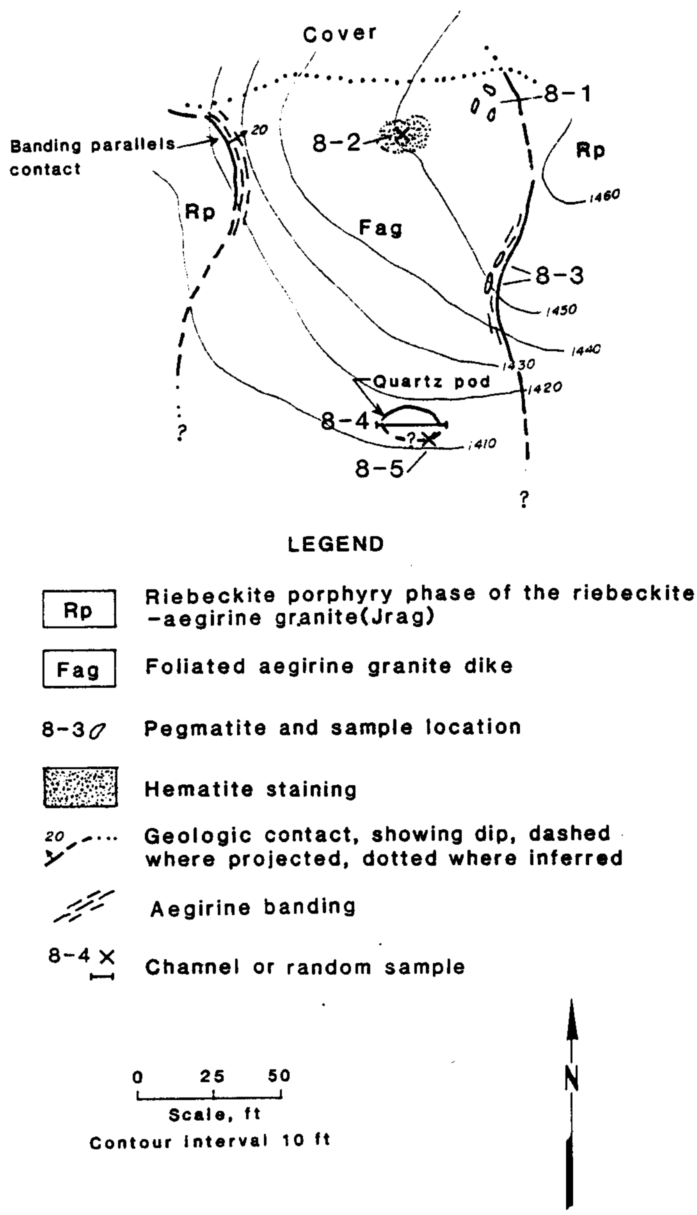


Figure 11 - Geologic and sample location map of the Little Joe prospect.

The most notable of the radioactive mineral occurrences, comprises several small, poddy, slightly radioactive (up to 700 cps) pegmatites. These pegmatites are near and locally elongated parallel to the upper contact of a north-trending, gently east-dipping, foliated aegirine granite dike that has intruded riebeckite granite. The pegmatites are generally irregular in shape with long dimensions rarely greater than a few ft. A single quartz-rich pod is discontinuously exposed over an inferred width of 10 ft and length of 25 ft. The mineralogy of the pegmatites is generally simple with quartz dominating and lesser albite and aegirine.

Sampling

Pegmatite samples contain elevated quantities of columbium, hafnium, titanium, yttrium, and zirconium, and lesser or locally high concentrations of REE, tantalum, and thorium (table 17). As is the case at many other prospects at Bokan Mountain, columbium concentrations are generally correlative to those of thorium and yttrium.

Resources

These occurrences represent negligible metal resources.

IRENE-D PROSPECT

General Description

The Irene-D prospect is located in a heavily forested western slope of uppermost Perkins Creek, east of Bokan Mountain. The original prospect, located in the 1960's, consists of pegmatite rubble in an area 200 ft across, and includes banded pegmatite cutting large boulders. During this investigation the pegmatite zone was traced for 1,000 ft along strike by a magnetometer survey and by outcrops, which were located about 400 ft southwest of the original discovery (fig. 12). Pegmatite rubble and outcrop were later found to trend southward for an additional 2,000 ft.

Pegmatite dikes at the Irene-D differ from the other pegmatite prospects near Bokan Mountain due to the abundance of magnetite and/or ilmenite. Magnetite occurs as bladed crystals up to 0.25 in long, but more commonly as finely disseminated grains in groundmass and anhedral masses up to 1 in diameter. Ilmenite generally occurs as disseminated grains. Magnetite locally composes up to 15 pct of the rock. In some hand specimens it appears the magnetite is replacing riebeckite.

Pegmatite masses or bands commonly comprise a massive quartz core surrounded by coarse feldspar (albite?), quartz, and riebeckite (often altered to aegirine) phenocrysts. Zircon is a minor constituent occuring as irregular fine-grained masses and as a groundmass constituent. Aegirine masses greater than 1 ft in diameter were noted. Southward along the pegmatite zone, ilmenite is more common than magnetite. Pyrite and unidentified radioactive and opaque minerals are accessory. The dikes are radioactive and typically measurements range from 500 to 1,000 cps, but locally range as high as 3,000 cps.

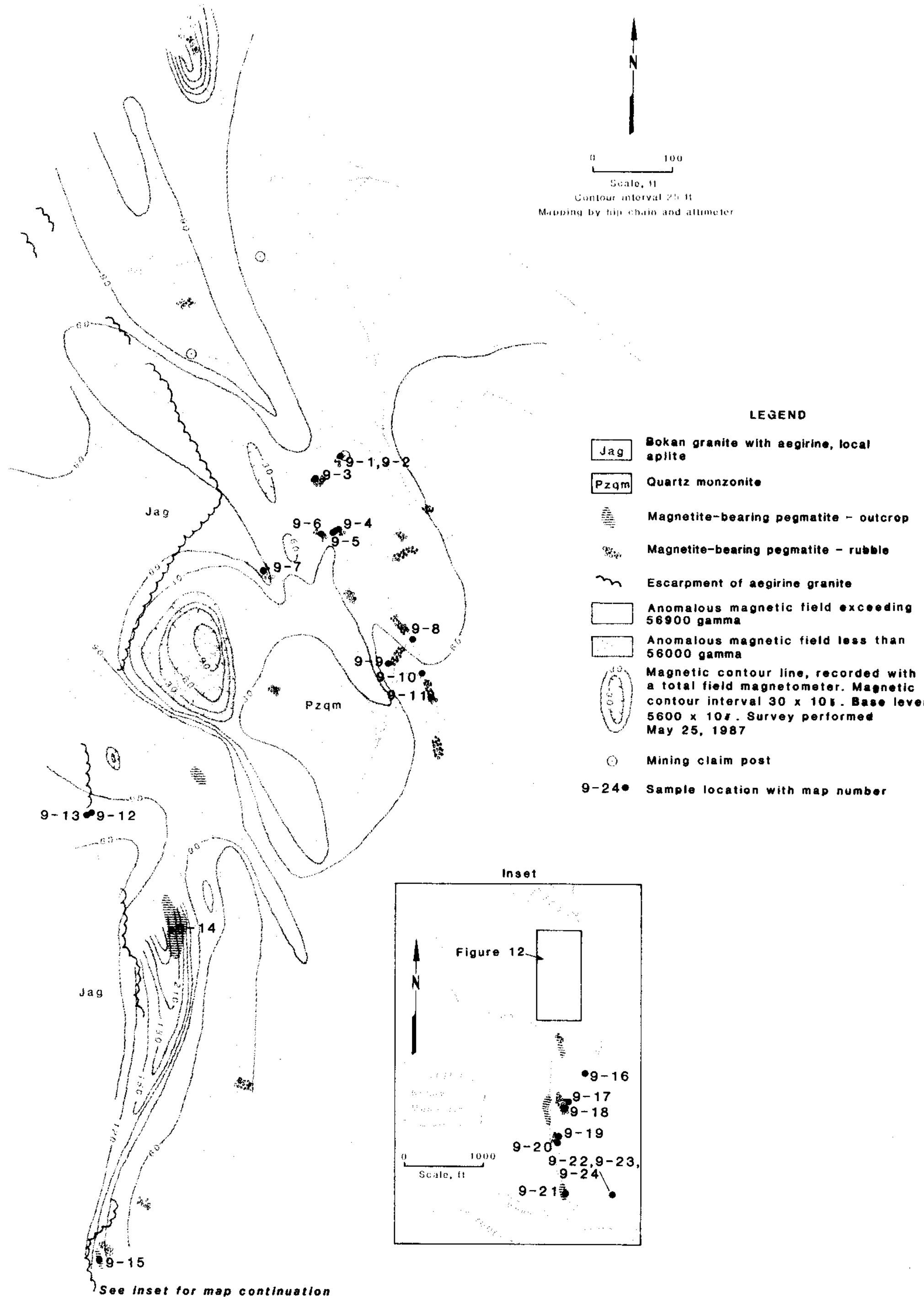


Figure 12 - Geologic, magnetic survey, and sample location map of the Irene-D prospect.

TABLE 17. - Analyses[1] of samples collected at the Little Joe prospect.

Sample	Type	Width (ft)	Analyses, ppm except as noted: Cb	Th	U	Y	Zr pct	Rare-Earth-Elements: La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE 2/
8-1....	Ch	0.5	950	255	17	2000	6.30	L	D	L	1000	L	L	L	L	L	L	400	L	100	L	2000
8-2....	R		90	155	4	900	.70	L	D	L	L	L	L	L	L	L	L	L	L	50	L	550
8-3....	R		550	225	36	200	1.90	L	L	D	L	L	L	L	L	L	L	L	D	200	L	720
8-4....	C	15.0	130	180	7	20	.20	L	D	D	L	L	L	L	L	L	L	L	L	L	L	1000
8-5....	R		520	185	7	4000	3.50	L	D	L	D	L	L	L	L	L	L	L	L	50	L	1050

C Channel sample. Ch Chip sample. D Detected. - Not analyzed. R Random sample.

[1]See table 4 for description of analytical methods.

[2]Estimates of "Total REE" include detection limit "D" values for elements detected near limits of quantification.

	Descriptions
8-1....	Limonite-stained quartz-aegirine pegmatite.
8-2....	Hematite-stained felty aegirine granite.
8-3....	Irregular quartz-albite pegmatite and hematite-stained aplite.
8-4....	Dominantly milky quartz with very minor aegirine and hematite pegmatite.
8-5....	Limonitic portion of 8-4 with highest radioactivity.

The Irene-D pegmatite zone consists of a 30- to 50-ft-wide zone of intermittent coarse-grained pegmatite masses, 3-6 in. in diameter, within aplite and aegirine granite. Where the zone was examined in outcrop, an inner continuous dike or band of pegmatite, 2- to 4-ft-thick (locally to 12-ft-thick) is present. The pegmatite zone is bounded to the west by aegirine to riebeckite-aegirine granite of the Bokan Mountain complex. To the east, the zone is adjacent to, or occurs near quartz monzonite. Thompson in 1982 (8), described a border zone pegmatite-aplite intrusive phase which he mapped on the north and south perimeter of the Bokan Mountain complex and interpreted to be the outermost unit of a ring-dike complex. The pegmatite zone of the Irene-D prospect is likely to be correlative to the border zone phase described by Thompson. Similar pegmatite zones (sample 9-25) were examined within the border zone on the north side of the Bokan Mountain complex.

Sampling

The pegmatite zones at the Irene-D prospect contain relatively low values of columbium, REE, yttrium, and zirconium compared to other pegmatites at Bokan Mountain. A few samples contain minor uranium and trace-levels of gold (up to 0.54 ppm). Samples were collected as random chips or continuous chips across pegmatite masses or bands exposed in outcrop or in large boulders. Results of those samples, representative of only the more consistent larger pegmatite zones (9-1 through 9-5, 9-11 through 9-14, and 9-19), indicate an average grade of only 185 ppm Cb, 775 ppm REE, and 620 ppm Y (table 18).

Several pegmatite samples located near (9-21) or within (9-22, 23) the Dotson Shear Zone prospect are included in table 18, but exhibit markedly different metal values. These pegmatites may not correlate with the border zone pegmatite. Note that samples 9-22 and 9-23 contain 260 and 1,800 ppm Be, respectively from a 5-ft-thick dike. Sample 9-12 was collected from a greisen-like sericite altered aegirine granite exposure west of the border zone pegmatite and contained 8,812 ppm REE (mostly cerium subgroup), 230 ppm Ta, and 676 ppm U. The extent of this occurrence is unknown.

Resources

Based on sampling, the results of a magnetometer survey, and field observations, it can be assumed that at least one generally continuous higher grade pegmatite band, averaging at least 3 ft in width, occurs along 3,000 ft of strike length extending southward from the original Irene-D prospect. Although an inferred resource of REE, yttrium, and zirconium is present the metal values are too low to constitute a significant resource on the basis of the present information. Further assessment of the greisen-like occurrences and the beryllium-yttrium mineralized dike is warranted.

The Irene-D prospect is likely to be part of the more extensive border zone pegmatite mapped by Thompson (8). Ultimate resources may be large, although likely of low grade, and include additional areas on the north and south perimeter of the Bokan Mountain complex.

TABLE 18. - Analyses[1] of samples collected at the Irene-D prospect.

Sample	Type	Width (ft)	Analyses, ppm except as noted[3] Cb	Th	U	Y	Zr pct	Rare-Earth-Elements La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE
9-1[2]...	G	-	100	23	14	180	0.17	34	136	-	25	6	1	-	-	-	-	-	-	34	5	241
9-2[2]...	G	-	180	97	50	1100	2.30	103	407	-	91	33	5	-	-	-	-	-	-	157	23	819
9-3[2]...	Ch	4.0	170	59	60	190	0.37	224	590	-	189	44	6	-	-	-	-	-	-	70	10	1133
9-4[2]...	Ch	2.0	180	75	34	910	0.94	118	315	-	94	26	4	-	-	-	-	-	-	106	15	678
9-5[2]...	Ch	2.0	160	51	21	620	0.69	108	259	-	67	19	3	-	-	-	-	-	-	76	11	543
9-6[2]...	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9-7[2]...	Ch	0.8	130	21	12	1000	1.4	322	476	-	215	26	3	-	-	-	-	-	-	19	3	1064
9-8[2]...	R	2.0	50	12	4	300	0.76	20	50	-	23	7	1	-	-	-	-	-	-	9	1	111
9-9[2]...	CR	-	190	170	26	670	0.59	60	157	-	58	13	2	-	-	-	-	-	-	39	6	335
9-10[2]..	CR	-	230	94	45	1000	1.20	208	542	-	172	41	5	-	-	-	-	-	-	119	17	1104
9-11[2]..	CR	-	550	140	82	1300	1.00	328	860	-	314	74	10	-	-	-	-	-	-	156	22	1764
9-12[2]..	Ch	2.0	60	140	676	110	0.26	2170	4100	-	1710	375	42	-	-	-	-	-	-	250	55	8812
9-13[2]..	CR	-	210	41	31	140	0.17	215	432	-	141	37	5	-	-	-	-	-	-	75	10	915
9-14[2]..	CR	-	140	36	16	270	0.19	67	154	-	51	13	1	-	-	-	-	-	-	30	4	320
9-15[2]..	CR	-	140	34	16	300	0.62	78	191	-	77	16	2	-	-	-	-	-	-	47	7	418

Descriptions

9-1....	Coarse grain, banded, quartz-zircon-magnetite-albite pegmatite with magnetite replacing riebeckite.
9-2....	Coarse grain, banded, quartz-zircon-magnetite-albite pegmatite with magnetite replacing riebeckite.
9-3....	Variable grain size pegmatite zone exposed in boulder float; magnetite, and aegirine replacing riebeckite.
9-4....	Well-banded pegmatite zone with magnetite and zircon masses; 900 cps.
9-5....	Well-banded pegmatite zone with magnetite and zircon masses; 900 cps.
9-6....	1.0 ft diameter, fine-grain, quartz-albite pod occurring in banded pegmatite zone 2 to 3 ft thick cutting boulders in float; up to 3,000 cps. Specimen only.
9-7....	Banded pegmatite zone in boulder, probably part of a wider zone.
9-8....	2 ft diameter boulder of banded pegmatite; 400 cps.
9-9....	10 lbs of random chips from numerous pieces of magnetite, zircon pegmatite in creek bed.
9-10...	Similar to above, some pieces noted to contain pyrite and trace arsenopyrite.
9-11...	Similar to above, although pegmatite float rock in this area has relatively more magnetite (+15 pct).
9-12...	Greisen-like, sericite altered zone in foliated (sheared?), mottled-textured aegirine granite with some floating coarse grains of quartz and albite, cut by a few dark grain veins up to 1/2 in thick.
9-13...	Bokan granite with disseminated (spinel?) mineral, probably ilmenite, cut by random dark colored, fine grain veins up to 1/4 in thick, twice local radiometric background (700 cps) for at least 30 ft around this site.
9-14...	Pegmatite zone in outcrop, dips steeply SE and varies from 4 to 10 ft thick; borders magnetite quartz monzonite and in turn aegirine Bokan granite to NW.
9-15...	Non-magnetic, non-radioactive pegmatite, >3 ft thick, in poorly exposed outcrop, contained disseminated (ilmenite?).

TABLE 18. - Analyses[1] of samples collected at the Irene-D prospect - continued

Sample	Type	Width (ft)	Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE[3]
			Analyses, ppm except as noted					Rare-Earth-Elements														
9-16[2]..	G	-	130	23	15	100	0.29	45	110	-	40	7	1	-	-	-	-	-	-	27	5	235
9-17[2]..	CR	-	230	63	27	210	0.32	227	507	-	240	48	5	-	-	-	-	-	-	68	10	1105
9-18[2]..	CR	-	100	90	26	130	0.30	237	567	-	231	51	7	-	-	-	-	-	-	114	17	1224
9-19[2]..	Ch	1.0	170	36	20	800	0.45	99	208	-	78	14	2	-	-	-	-	-	-	34	5	440
9-20[2]..	Ch	0.3	440	48	14	610	0.45	53	168	-	34	10	1	-	-	-	-	-	-	54	9	329
9-21[2]..	Ch	1.0	3500	15	30	1000	1.70	190	397	-	210	40	4	-	-	-	-	-	-	52	8	901
9-22[2]..	Ch	6.0	50	63	97	320	0.32	28	82	-	22	6	1	-	4	-	-	-	-	36	7	186
9-23...	Ch	5.0	55	285	N	20000	0.03	L	L	D	L	L	L	L	L	L	D	L	L	D	L	710
9-24...	G	-	112	1310	107	200	0.10	L	L	L	L	L	L	L	L	100	D	L	L	50	L	250
9-25[2]..	Ch	3.0	80	97	61	960	3.60	214	508	-	157	34	5	-	11	-	-	-	-	193	30	1152

C Channel sample. Ch Chip sample. CR Random chip sample. H High grade sample. D Detected. - Not analyzed. L Less than detectable.
I Interference.
[1]See table 4 for description of analytical methods, additional analyses presented in appendix.
[2]Analyzed at a commercial laboratory.
[3]Estimates of "Total REE" includes detection limit "D" values for elements detected near limits of quantification. All 1986-1987 REE values are minimum-only due to self-shielding effect during neutron-activation analysis of samples with REE concentrates; 1986-1987 analyses also do not include values for Pr, Gd, Tb, Dy, Ho, Er, and Tm.

Descriptions	
9-16...	Spotty pegmatite in quartz monzonite boulders; 450 cps.
9-17...	Aegirine-rich pegmatite with zircon and ilmenite; aegirine occurs as veins, coarse crystals, and masses up to 1.5 ft across.
9-18...	3 ft x 4 ft boulder of irregular and spotty clots of pegmatite within quartz monzonite, clot of zircon and magnetic (ilmenite?); 250 cps.
9-19...	Sample across wider of a series of aegirine-quartz-feldspar dikes occurring in a 20-ft-wide zone striking 115_ and dipping 80_N in road cut, zone cuts medium grain quartz monzonite; 500 cps.
9-20...	0.3 ft thick dike with coarse-bladed riebeckite-magnetite-ilmenite, pyrite-zircon-quartz in core.
9-21...	1.0 ft thick pegmatite dike, striking 110_, near vertical dip, non-magnetic, cutting riebeckite granite, there are at least 3 or 4 more subparallel smaller dikes in a 15-ft-wide zone; 2,500 cps on dike.
9-22...	Sheared coarse pegmatitic zone on footwall to fault; minor magnetite and unidentified black mineral.
9-23...	Felsic dike that has intruded shear zone; 2,500-3,000 cps.
9-24...	Grab from particularly radioactive (10,000-16,000 cps) pod about 1.0 ft across. 40 ft to east along dike sampled in 9-23. Possible secondary uranium mineral.
9-25...	3-ft-wide magnetite-zircon pegmatite band traced for 50 ft in outcrop and continues under cover in both directions along strike of 125_. Part of border zone pegmatite phase. Sample located on northwest side of Bokan Mountain, SE 1/4 of Sec. 17.

*** DIKE DEPOSITS

Vein-like mineralized dikes contain the majority of columbium, REE, beryllium, tantalum, yttrium, and zirconium resources at Bokan Mountain. In excess of 35,000 ft of strike length consisting of five systems of parallel mineralized dikes have been identified. Approximately 8,000 ft of this strike length at the I and L and Dotson prospects was previously reported by Staatz, in 1978 (6). Most of the dikes are open-ended and extend under vegetative or glacial till cover or under sea water. The dikes dip steeply and invariably trend west-northwest to north-northwest, forming a broad mile-wide zone radiating outward into country rock northwest and southeast from the Bokan Mountain granite (fig. 13, photo).

Dike systems are spatially associated with the aplite phase of the intrusion. The aplite phase is characterized by common and highly variable zones of aplite and pegmatites of various compositions. The dikes vary in texture, width, and trace-element composition along their strike lengths. Close-in they are relatively wider and more pegmatitic and have higher uranium/thorium ratios as well as uranium and thorium concentrations. Outwards from the granite, the dikes bifurcate into many thinner dikes that occupy a widening zone as the distance increases. With greater distance from the granite the dikes also become increasingly finer-grained equigranular, and have lower uranium/thorium ratios with high concentrations of all REE, columbium, and zirconium. In the order of generally decreasing abundance the most abundant REE are yttrium, cerium, neodymium, lanthanum, and samarium. The other REE, especially gadolinium, dysprosium, holmium, erbium, and thulium are also present in variable, but noteworthy concentrations. The dikes have trace to minor amounts of a wide variety of other valuable elements including beryllium, gallium, germanium, gold, hafnium, lead, lithium, palladium, rubidium, silver, strontium, tantalum, tin, vanadium, and zinc.

A complex suite of REE, columbium, thorium, and uranium minerals have been identified in the dikes[8/]. Columbium is contained in minerals of the

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8/Identifications by SEM made by Cheryl Mardock, geologist, Bureau of Mines, Albany, Oregon.

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euxenite-polycrase series, but minor amounts are also contained in columbite, aeschynite, and fergusonite. Yttrium is contained in thalenite, or its alteration product tengerite, in addition to xenotime. Other REE are largely contained within bastnaesite, parisite, synchysite, xenotime, and monazite. Preliminary SEM analyses suggests that bastnaesite and thalenite are the most common REE minerals. Thorium and uranium are largely contained in thorite and urano-thorite. All of these minerals are often associated with zircon, either within microveinlets or as a replacement (?) of albite and quartz in the matrix of the dikes. Uranium, to some extent, is partially leached from the surface exposures from which the samples were collected. Other minerals identified in the dikes include aegirine, barite, biotite, calcite, epidote, fluorite, galena, iron oxides, microcline, microperthite, magnetite, pyrite, riebeckite, native silver, and sphalerite.

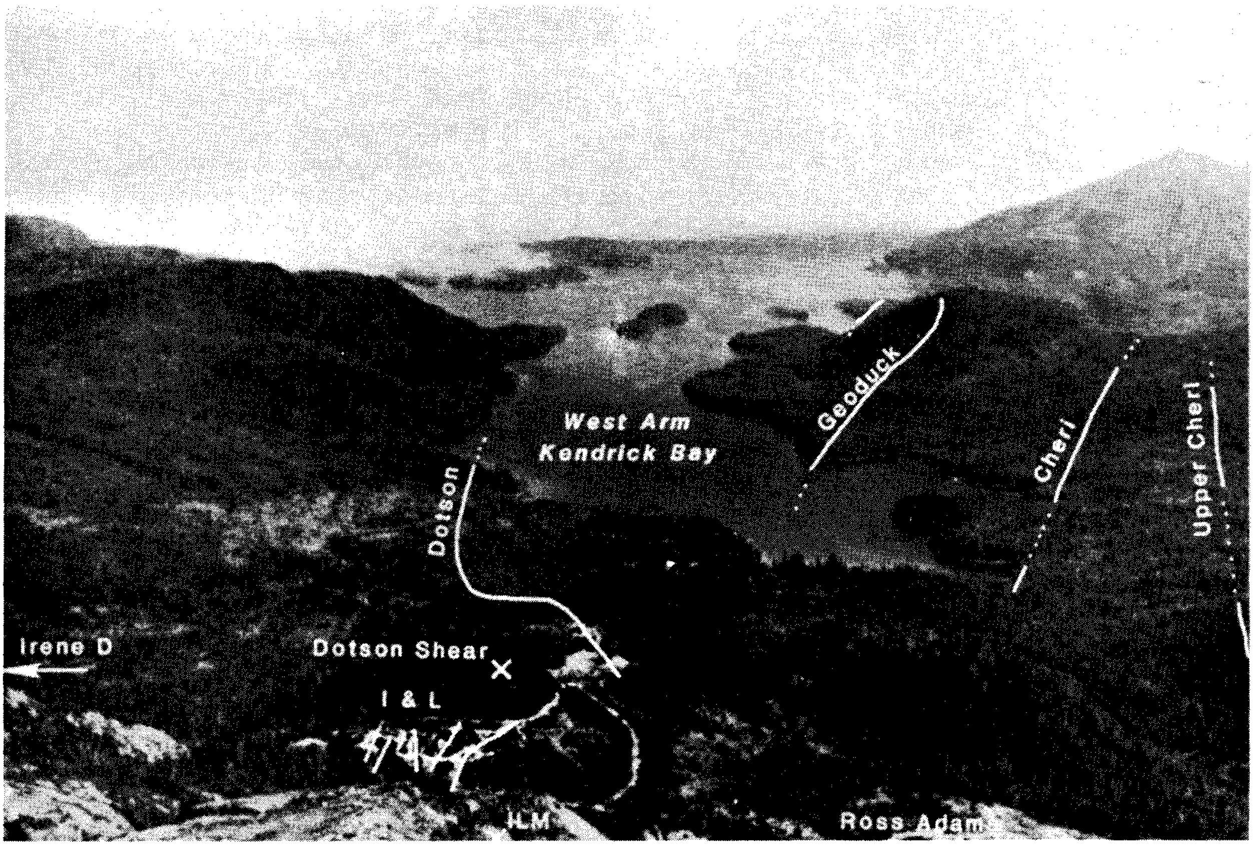


Figure 13 - Photograph showing traces of the Dotson, Cheri, and Geoduck dike systems.

GEIGER PROSPECT

General Description

The Geiger prospect is located north of Bokan Mountain extending from near an aplite outlier of the peralkaline granite northerly to beyond the north shore of South Arm Moira Sound (figs. 14-16). The prospect was initially located by MacKevett (3) on the south shore of the South Arm Moira Sound and described as a single exposure of a 6-ft-wide radioactive, altered felsic dike cutting metavolcanic rocks. The prospect was noted to contain columbium, REE, and other elements, however, the uranium content was relatively low (280 ppm) and consequently no further exploration along strike was conducted.

During the present investigation, the Geiger prospect was found to consist of an apparently continuous system of one to five or more parallel radioactive dikes that can be traced in float, outcrop, and test pits for approximately 8,700 ft of strike length. The overall trend of the dikes is approximately N15°W, but individual measurements vary between N15°E and N30°W. The dikes have a somewhat sinuous trace that may in part result from the interaction of their variable dip and the sloping topography. Projection of the dikes across the South Arm Moira Sound is indicated by the sea-floor continuation of a low narrow ridge-like feature that hosts the dikes onshore. This ridge was traced offshore by means of bathymetric transects. The dikes of the Geiger prospect are interpreted to be cut by and show minor right-lateral offset along a major northeast-trending fault and minor subsidiary faults that parallel and underlie the South Arm Moira Sound.

The Geiger prospect dike system varies in width along strike. Between Perkins Creek and the South Arm Moira Sound one large continuous dike and locally, at least one parallel dike is present (fig. 15 and table 19). The main dike averages in excess of 5.0-ft-wide in this area each and ranges between 4.0 to greater than 8.5 ft (see also head assay in appendix C). In contrast, north of South Arm Moira Sound the Geiger prospect consists of numerous thinner, parallel dikes occurring in a zone with a total width of approximately 200 ft. The dikes in this area range between less than .1 to 1.8-ft-wide, averaging about 1.0-ft-wide. Similarly, south of Perkins Creek where the Geiger system encounters quartz monzonite country rock, it appears to spread into numerous narrow dikes that range from mere pencil line width to 0.5 ft over a zone width of at at least 20 ft. Dikes in this area commonly bifurcate, rejoin, and feature variable widths.

Between Perkins Creek and the South Arm Moira Sound the main Geiger dike is highly variable in character consisting of cross-cutting units of locally banded porphyritic to non-porphyritic, green-colored fine- grained granular aegirine-bearing quartz-albite-zircon dike rock. There are less abundant units of buff-colored flow-banded aplite and pegmatite. All of the dike rock types may have cross-cutting veinlets of quartz or opaque minerals and some of the more siliceous rocks also contain minor amounts of disseminated and veinlet pyrite, sphalerite, galena, and fluorite. Radioactivty of the dike is ubiquitous, but highly variable, ranging between 400 and 2,100 cps.

North of the South Arm Moira Sound and south of Perkins Creek, the Geiger prospect dikes are less variable in composition and texture. In this area they are buff to brown, fine-grained granular, and composed largely of quartz and albite with minor fluorite and cross-cutting veinlets of opaque minerals. Radiometric levels of the dikes in this area range between 450 and 1,900 cps.

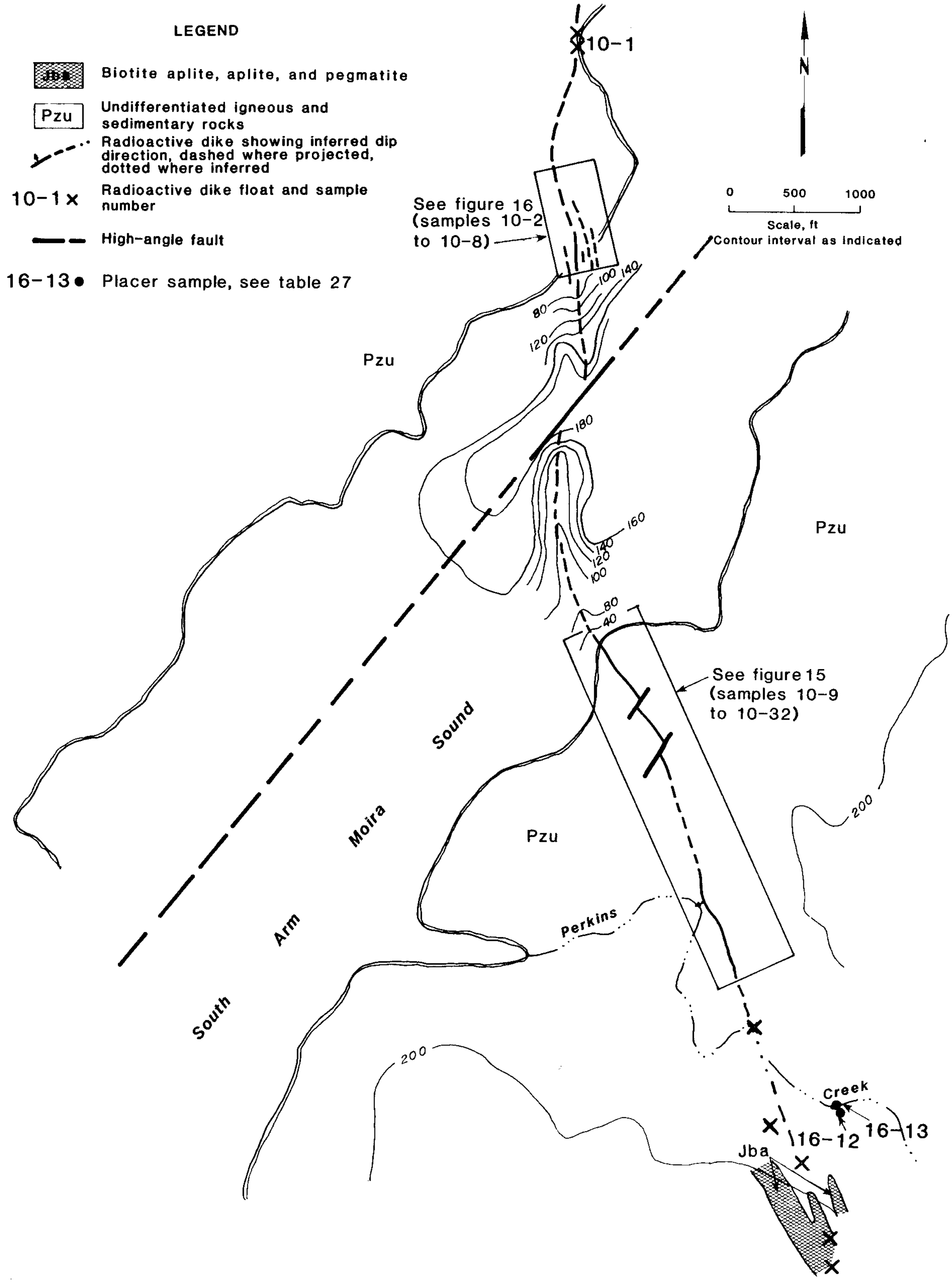


Figure 14 - Geiger prospect dike system.

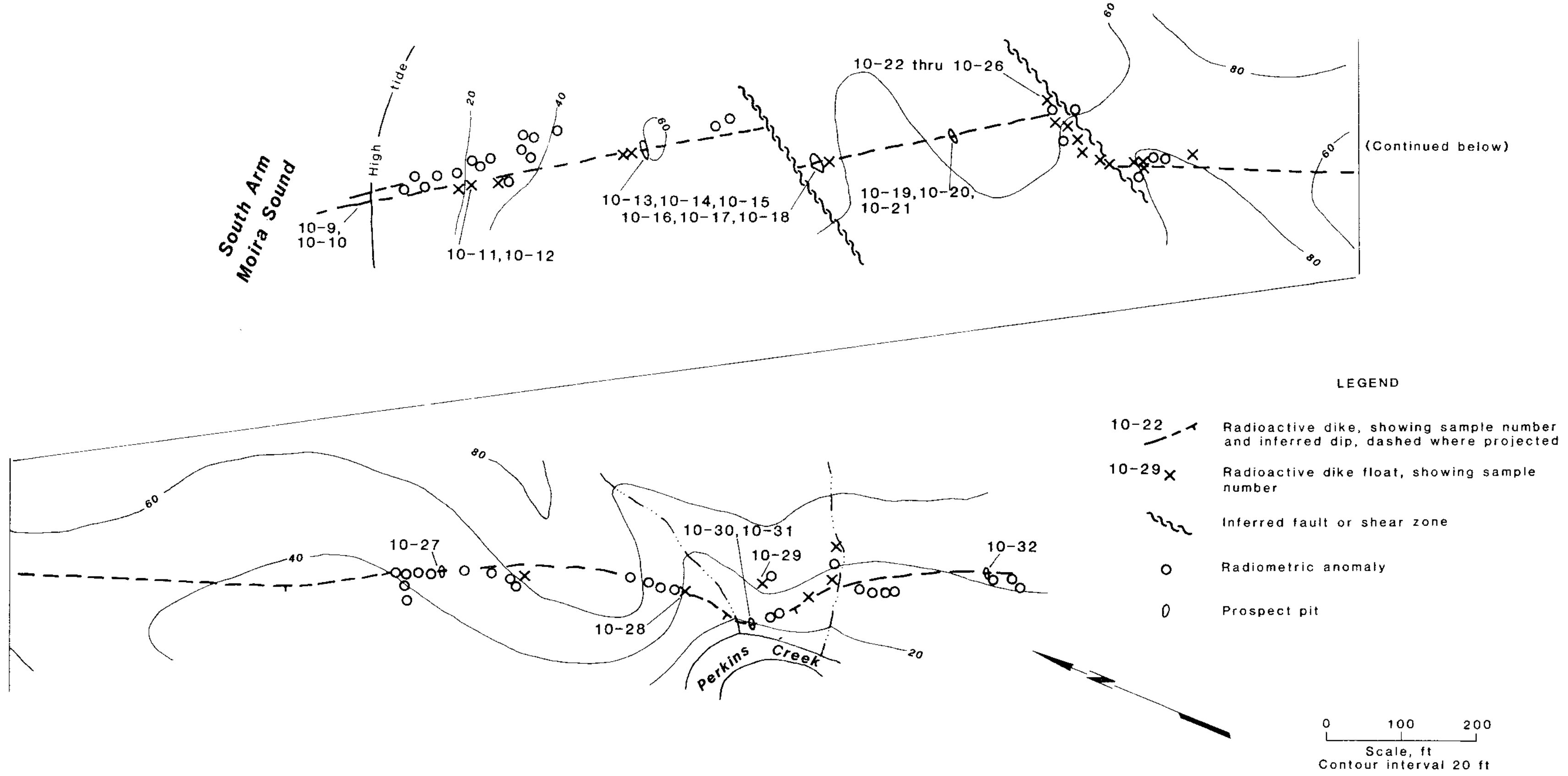


Figure 15 - Map of the Geiger prospect between Perkins Creek and South Arm Moira Sound.

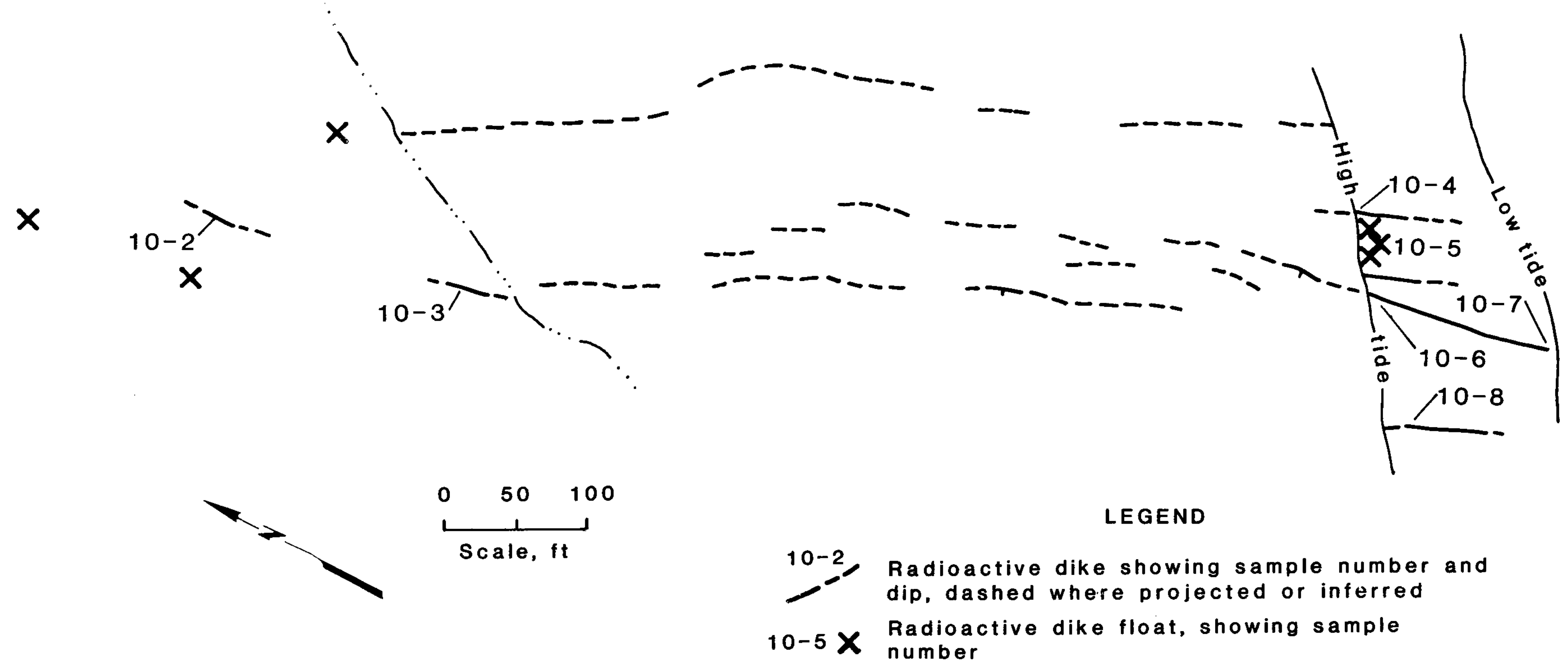


Figure 16 - Map of the Geiger prospect north of South Arm Moira Sound.

TABLE 19. - Analyses[1] of samples collected at the Geiger prospect.

Sample 2/	Type	Width (ft)	Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE 3/
			Analyses, ppm except as noted					Rare-Earth-Elements														
10-1...	CR	0.7[4]	2000	360	191	2700	2.40	742	1770	-	760	194	25	-	-	-	-	-	-	306	42	3840
10-2...	Ch	2.4	350	85	57	940	0.62	90	284	-	74	253	4	-	-	-	-	-	-	85	11	4640
10-3...	C	3.0	650	350	104	2000	1.10	421	1080	-	391	104	14	-	-	-	-	-	-	187	24	2221
10-4...	C	0.8	1700	460	183	4900	1.00	1010	2220	-	988	272	37	-	-	-	-	-	-	311	39	7098
10-5...	CR	0.9[4]	750	440	196	4500	2.40	968	2190	-	976	260	34	-	-	-	-	-	-	364	50	4782
10-6...	Ch	3.3	510	160	99	2000	1.00	310	673	-	253	75	10	-	-	-	-	-	-	144	20	1489
10-7...	C	1.7	1100	48	174	2400	2.30	525	1260	-	482	121	14	-	-	-	-	-	-	219	35	2657
10-8...	C	0.6	620	150	101	2500	1.10	603	1450	-	633	177	21	-	-	-	-	-	-	181	25	3090
10-9...	Ch	6.0	1560	90	154	400	1.40	8000	D	-	3000	L	L	-	-	-	-	-	-	100	L	11500
10-10..	Ch	6.0	220	85	23	D	0.01	60	D	-	L	L	L	-	-	-	-	-	-	L	L	60
10-11..	Ch	1.5	2800	50	484	880	1.70	83	328	-	47	18	2	-	-	-	-	-	-	191	38	706
10-12..	C	1.6	2000	37	264	700	0.19	37	180	-	32	15	1	-	-	-	-	-	-	167	27	459

Descriptions

Sample	Description
10-1...	Chips from about a dozen pieces of angular dike float. No wall rock sample.
10-2...	Sample includes a 5-in-wide and a 1.5-in-wide dark fine-grained radioactive dike (450 cps) and 22.5-in-wide section of wall rock between dikes.
10-3...	Sample of 1.3-ft-wide dike and quartz diorite wall rock to either side.
10-4...	0.5-ft-wide dike and 1.5-in-wide section of hanging wall and footwall; 1,900 cps.
10-5...	Chips of .8 - .9-ft-wide radioactive dike (1,500 cps) in float.
10-6...	Sample across 1.8-ft-wide dike and equal amount of wall rock from both sides.
10-7...	Radioactive dike; 1,000 cps.
10-8...	0.3-ft-wide dike and .15-ft-wide selvage on either side. Minor fluorite.
10-9...	Dike with up to 2% disseminated pyrite and common quartz-pyrite veinlets that are up to 0.5-in-wide and parallel to the dike margins.
10-10..	Locally bleached and brecciated pyrrhotite- and pyrite-bearing hornfels. Country rock adjacent to 10-9. Minor fluorite replacement and veinlet and coarse muscovite-quartz-pyrite pods occur near dike contact; 400 to 2,100 cps near dike.
10-11..	Sample consists of 10-in-wide silicic, pyritized, granular dike crosscut by thin dark quartz veinlets and 8-in-wide pyritized, locally galena-bearing, somewhat punky looking altered dike. Adjacent to sample 10-12.
10-12..	Light green granular vein material cut by 2-in-wide dikes of dark gray siliceous and pyritic (possible traces of sphalerite and galena) dikes; 1,200 - 1,300 cps.

TABLE 19. - Analyses[1] of samples collected at the Geiger prospect.- continued

Sample 2/	Type	Width (ft)	Analyses, ppm except as noted: Cb	Th	U	Y	Zr pct	Rare-Earth-Elements: La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE 3/
10-13..	C	6.5	1800	52	184	1200	1.90	63	242	-	51	18	2	-	-	-	-	-	-	167	23	566
10-14..	C	2.0	40	52	4	290	0.02	169	446	-	275	61	6	-	-	-	-	-	-	21	3	980
10-15..	Ch	3.2	110	28	10	150	0.02	163	339	-	139	33	4	-	-	-	-	-	-	10	1	1670
10-16..	C	2.8	1600	64	187	1200	1.40	1650	2750	-	1130	98	11	-	-	-	-	-	-	156	27	5822
10-17..	C	4.1	1500	26	139	1400	1.60	451	822	-	294	47	5	-	-	-	-	-	-	132	21	1772
10-18..	C	1.6	2100	25	158	470	1.60	471	906	-	420	73	7	-	-	-	-	-	-	38	6	1920
10-19..	C	4.3	1500	63	243	1700	2.40	2450	3900	-	1110	90	7	-	-	-	-	-	-	206	33	7797
10-20..	C	1.5	40	110	5	990	0.03	66	216	-	96	45	8	-	-	-	-	-	-	48	5	483
10-21..	C	1.5	20	129	4	140	0.02	59	137	-	62	15	2	-	-	-	-	-	-	9	1	285
10-22..	C	2.3	I	31	140	I	I	270	504	-	180	28	4	-	-	-	-	-	-	23	5	1015
10-23..	C	0.7	1600	130	209	1600	2.40	106	369	-	67	29	5	-	-	-	-	-	-	289	41	906
10-24..	C	0.7	2500	16	204	320	1.90	154	311	-	81	18	2	-	-	-	-	-	-	24	4	602

Descriptions

Sample	Description
10-13..	Light green granular dike material cutting a blue-gray porphyritic dike (?) and dark green banded rock.
10-14..	Light-green-weathered granular dike (11-in-wide) with fine, green, cross-cutting veinlets adjacent to 13 inches of silicic and pyritic quartz diorite. Forms northeast wall rock to dike of sample 10-13.
10-15..	Granular, light-green, slightly porphyritic altered quartz diorite (14-in-wide) and pyritic quartz diorite. Wall rock on southwest side of 10-13.
10-16..	Southerly portion of outcrop in trench consisting of 2.7 ft of fine-grained, granular, greenish-colored dike material; (400 - 800 cps) and .1 ft of dark fine-grained silicic volcanic rock.
10-17..	Central portion of dike outcrop in trench consists of green, fine-grained granular sometimes porphyritic dike material; 400 - 750 cps.
10-18..	Northerly portion of dike outcrop in trench. Mixture white to green, sometimes porphyritic fine-grained granular dike material; 500 - 950 cps.
10-19..	Dike consisting of mixture of gray and green fine-grained granular material; 600 - 800 cps.
10-20..	White to green rock grading into a dark fine-grained altered rock (wall rock?); 300 cps.
10-21..	Hanging wall to 10-19, consists of white punky rock grading into fine-grained quartz diorite; 200-275 cps.
10-22..	Light green granular and porphyritic dike material cut by thin greenish veinlets and local pegmatitic pods; 1,00-2,000 cps.
10-23..	Green granular dike material with veinlets containing a bladed black mineral; 1,600-2,000 cps. This material interfingers with an aplitic dike.
10-24..	Buff to white aplite separating two zones of green-colored dike material; features flow banding at orientations not parallel to dike orientation; 1,200 cps.

TABLE 19. - Analyses[1] of samples collected at the Geiger prospect - continued

Sample [2/]	Type	Width (ft)	Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE [3/]
			Analyses, ppm except as noted					Rare-Earth-Elements														
10-25..	Ch	1.7	1800	38	284	390	0.26	418	700	-	274	31	4	-	-	-	-	-	-	36	6	1470
10-26..	Ch	3.0	710	72	149	1900	2.60	1830	2640	-	591	66	7	-	-	-	-	-	-	265	41	6909
10-27..	C	4.5	1900	75	134	3400	1.40	677	1390	-	498	125	16	-	-	-	-	-	-	266	40	3013
10-28..	C	2.0	760	330	162	1900	2.70	93	290	-	41	21	5	-	-	-	-	-	-	328	48	825
10-29..	C	4.0	960	220	132	1100	2.60	33	248	-	25	15	2	-	-	-	-	-	-	261	34	618
10-30..	C	4.0	770	110	114	850	1.20	66	250	-	46	18	2	-	-	-	-	-	-	154	24	560
10-31..	Ch	2.0	430	21	41	210	0.10	150	266	-	85	14	2	-	-	-	-	-	-	19	3	539
10-32..	C	4.0	1000	320	146	1300	2.70	127	438	-	77	29	4	-	-	-	-	-	-	321	48	1044

C Channel sample. Ch Chip sample. D Detected. - Not analyzed. CR Random sample. L Less than detection limit. I Interference.
[1]See table 4 for description of analytical methods, additional analyses are presented in the appendix.
[2]All samples in this table were analyzed at a commercial laboratory.
[3]Estimates of "Total REE" include detection limit "D" values for elements detected near limits of quantification. All 1986-1987 REE values are minimum-only due to self-shielding effect during neutron-activation analysis of samples with REE concentrates; 1986-1987 analyses also do not include values for Pr, Gd, Tb, Dy, Hob, Er, and Tm.
[4]Minimum width indicated by float boulders.

Sample	Descriptions
10-25..	Banded felsic quartz porphyry aplite and green massive altered dike material with quartz porphyroblasts.
10-26..	Green massive felsic dike material with 2-3 mm sized quartz porphyroblasts cut by ropey banded cream and green colored felsic dike material with quartz porphyroblasts.
10-27..	Fine-grained granular green-colored dike material with disseminated pyrite and galena(?); 1,200 cps. Grades to porphyritic diorite to south; northly contact not exposed.
10-28..	Float boulder on line of radiometric anomalies. Rubble in trench suggests true width of 3 to 4 ft. Material consists of punky and granular banding caused by a fibrous green mineral.
10-29..	Float boulder consisting of 3.5-ft-wide central granular greenish-gray material with minor pyrite and sphalerite and .5-ft-wide pegmatic selvage; 700-1,000 cps.
10-30..	Sample across two dikes (1-ft- and 2-ft-wide) consisting of blue-gray granular material with 2% - 3% disseminated pyrite and minor sphalerite and galena; 1,500-1,300 cps.
10-31..	Chips of wallrock from 1 ft on both sides of sample 10-30. Quartz monzonite cut by numerous blue-green veinlets.
10-32..	Punky green granular aplitic dike with chlorite-veined quartz monzonite wallrocks. More pegmatitic at northern margin where a .5-in wide aegirine dike occurs; 1,700-1,900 cps.

Sampling

Between Perkins Creek and the South Arm Moira Sound the main Geiger prospect dike averages 1,530 ppm Cb, 82 ppm Th, 176 ppm U, 1,318 ppm Y, 1.8 pct Zr, and 3,890 ppm REE over an average width of 5.0 ft (table 19). The northern portion of this dike segment generally has higher columbium and uranium grades, but lower thorium, yttrium, and zirconium grades than the southern portion. Samples of the buff-colored, flow-banded aplite unit along this segment also have relatively higher columbium and possibly uranium, but lower yttrium, zirconium, and thorium grades than samples of the green-colored aegirine-bearing, fine-grained granular, quartz-albite-zircon dike rock. In this area, the dike also contains local traces of gold, lead, and zinc, up to 40 ppm Ge (average of 20 ppm) and 530 ppm Ta (average of 118 ppm), and up to 530 ppm Hf (average of 390 ppm).

North of the South Arm Moira Sound, on the other hand, the average of all samples collected is 756 ppm Cb, 222 ppm Th, 119 ppm U, 2,260 ppm Y, 1.3 pct Zr, and 2,249 ppm REE over 1.7 ft. Many of these samples also included wall rock. The dikes in this area contain traces of gold, lead, zinc, up to 40 ppm Ge (average is 21 ppm) and 460 ppm Hf (average is 315 ppm).

Resources

Continuous mineralization is apparent along 3,100 ft of dike strike length between Perkins Creek and its outcrop on the South Arm Moira Sound (fig. 15). Assuming one-half the strike length to represent depth at a grade and width equivalent to the average of samples collected along this dike segment, an indicated resource is:

7,497,000 lb Cb	6,458,000 lb Y
402,000 lb Th	8,820,000 lb Zr
862,000 lb U	19,061,000 lb REE
	578,000 lb Ta

This resource is contained within approximately 2,450,000 st of rock with a tonnage factor of 9.8 ft^3/st.

An inferred resource can be estimated for the entire 5,600 ft of strike length along the dike south of the fault that underlies the South Arm Moira Sound. Continuous mineralization similar to that between Perkins Creek and the South Arm Moira Sound is assumed. With a projected mineralized depth of 2,500 ft and grades the same as for the indicated resource, an inferred resource within 4,693,000 st of mineralized rock is:

14,361,000 lb Cb	168,948,000 lb Zr
770,000 lb Th	36,512,000 lb REE
1,652,000 lb U	1,108,000 lb Ta
12,371,000 lb Y	

The inferred estimates are in addition to the indicated resources contained in this segment of the Geiger dike system.

Further inferred resources can be estimated for the northern portion of the Geiger dike system by summing the mapped lengths of the dikes in figure 16 and assuming that at least two dikes continue south 900 ft to the fault and north 1,000 ft to sample location 10-1 (figs. 14 and 15). At a grade equal to the weighted average of all samples collected from this area adjusted to a mining width of 3.0 ft (428 ppm Cb, 126 ppm Th, 67 ppm U, 1,281 ppm Y, 0.737 pct Zr, and 1,270 ppm REE), an inferred resource contained within 2,600,000 st rock is:

2,226,000 lb Cb	6,661,000 lb Y
655,000 lb Th	38,324,000 lb Zr
348,000 lb U	6,604,000 lb REE

This calculation was made on a depth basis of 1,500 ft for the overall 3,000 ft strike length of this portion of the dike system.

I AND L PROSPECT

General Description

The I and L prospect is located near the 1,100-ft elevation on the southeastern flank of Bokan Mountain (figs. 2 and 17). The prospect consists of six principal and numerous smaller mineralized dikes that cut albitized quartz monzonite and aplite adjacent to the Bokan Mountain peralkaline granite. Numbered 1 through 6 on figure 17, the dikes trend west-northwest, normal to the peralkaline granite contact. The dikes are offset several hundred feet north along the north-trending Dotson shear zone from probable correlative dikes of the Dotson dike prospect.

The No. 1 dike is the widest and largest of the I and L dikes with a strike length of at least 900 ft and width that varies from less than 1.0 ft to 18.0 ft in surface exposures. Drilling by claim owners in 1977 to depths of 260 ft indicates that it has an irregular shape, especially to the northwest, and locally bifurcates. On its northwestern end, the No. 1 dike is truncated at a depth of approximately 200 ft by a shallowly dipping shear zone.

The I and L No. 1 dike has two principal outcropping splays. On the western 200 ft of the splay closest to the Bokan Mountain granite, mineralization is hosted by brecciated and limonite-stained peralkaline granite and pegmatite. A central portion of some 200 ft, in the same splay, is characterized by a more pegmatitic texture, an increase in abundance of aegirine, and a quartz monzonite host rock. The east end of this splay along with the second splay further from the granite is composed of abundant quartz and narrow aplitic and pegmatitic zones that cut fractured and iron-stained host rocks.

At least five less extensive and narrower dikes (Nos. 2 through 6) parallel the No. 1 dike to the south. The mapped strike length of these dikes varies from 100 to 500 ft and widths vary from a few inches to as much as 6.0 ft. Drill intersections indicate these dikes are vertical to steeply dipping (figs. 18, 19, 20, 21, 22). Dike Nos. 2 through 6 are generally more pegmatitic than is dike No. 1 and typically contain a quartz-rich core bounded by a selvage of limonite- stained, fine-grained albite and various opaque minerals (fig. 23).

Accessory minerals identified by SEM analyses[9/] or in hand samples from the I and L and Dotson prospects include zircon, hematite,limonite, pyrolusite,

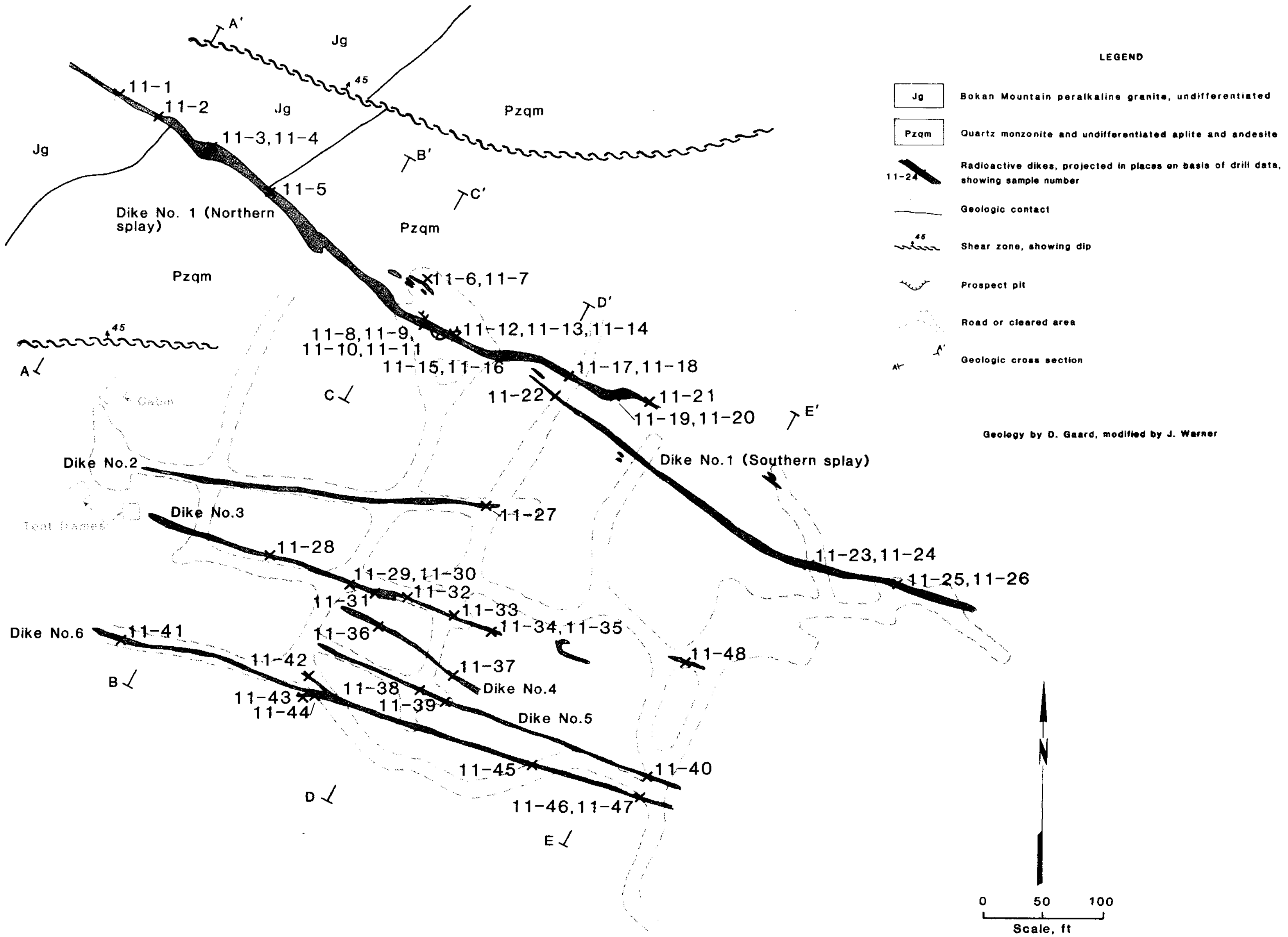


Figure 17 - Geologic and sample location map of the I and L prospect.

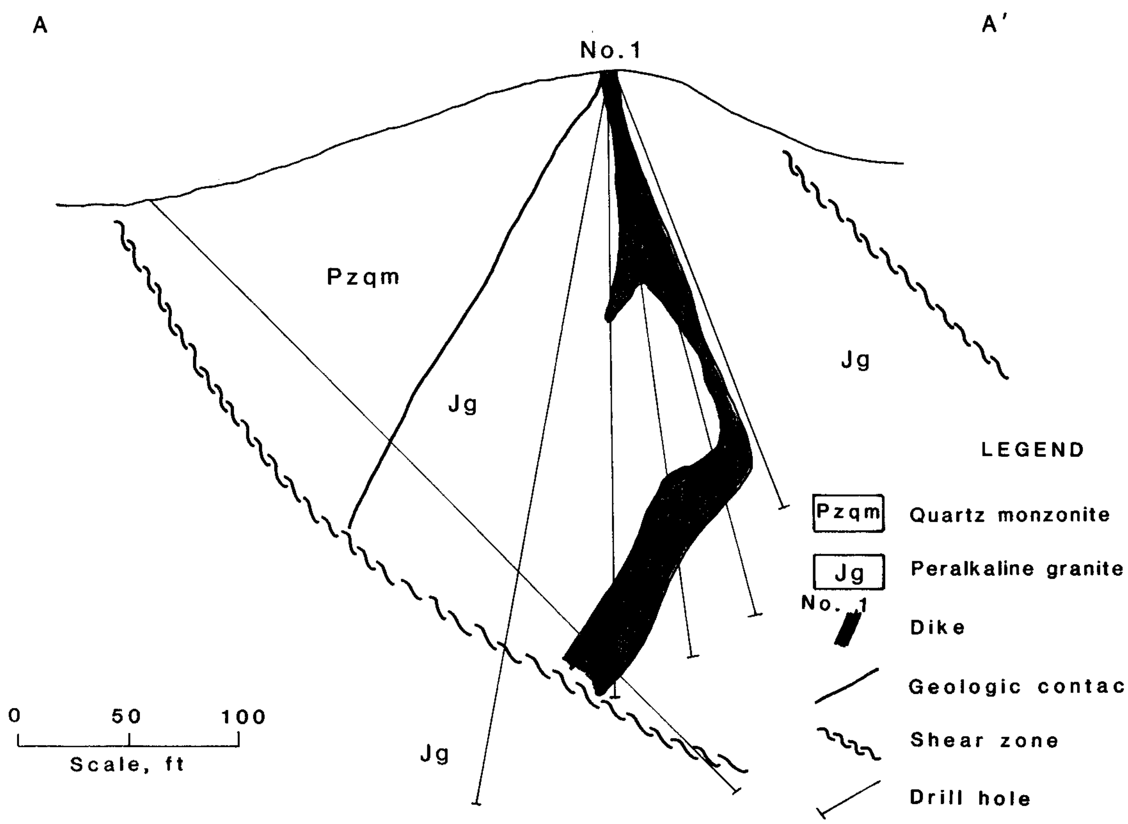


Figure 18 - Geologic cross section A-A', I and L prospect.

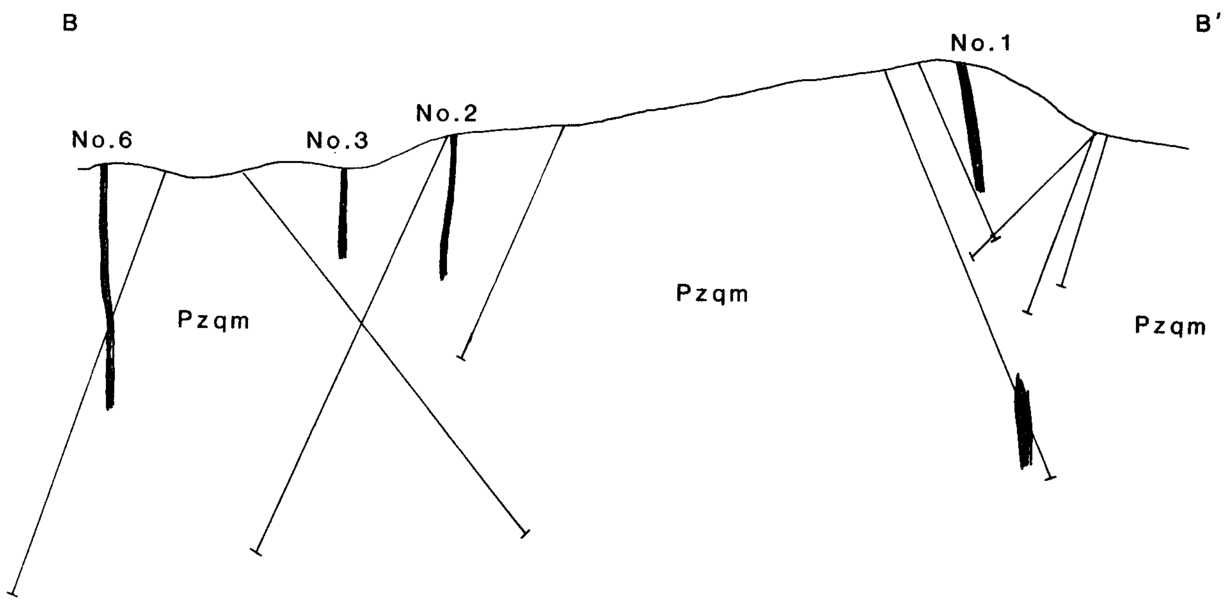


Figure 19 - Geologic cross section B-B', I and L prospect.

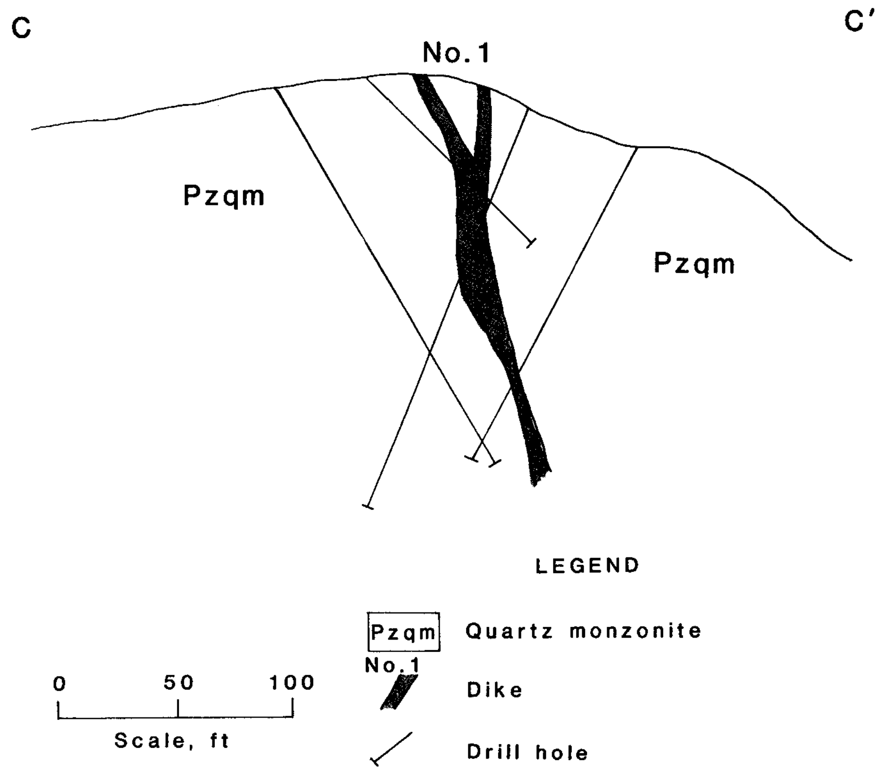


Figure 20 - Geologic cross section C-C', I and L prospect.

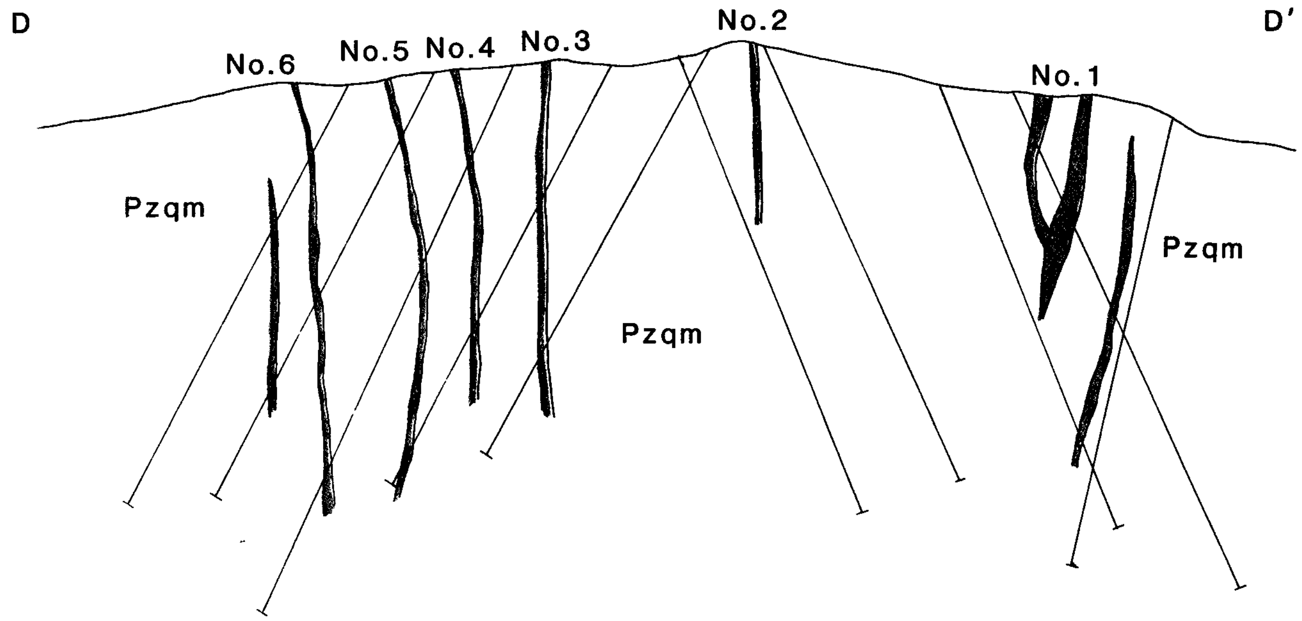


Figure 21 - Geologic cross section D-D', I and L prospect.

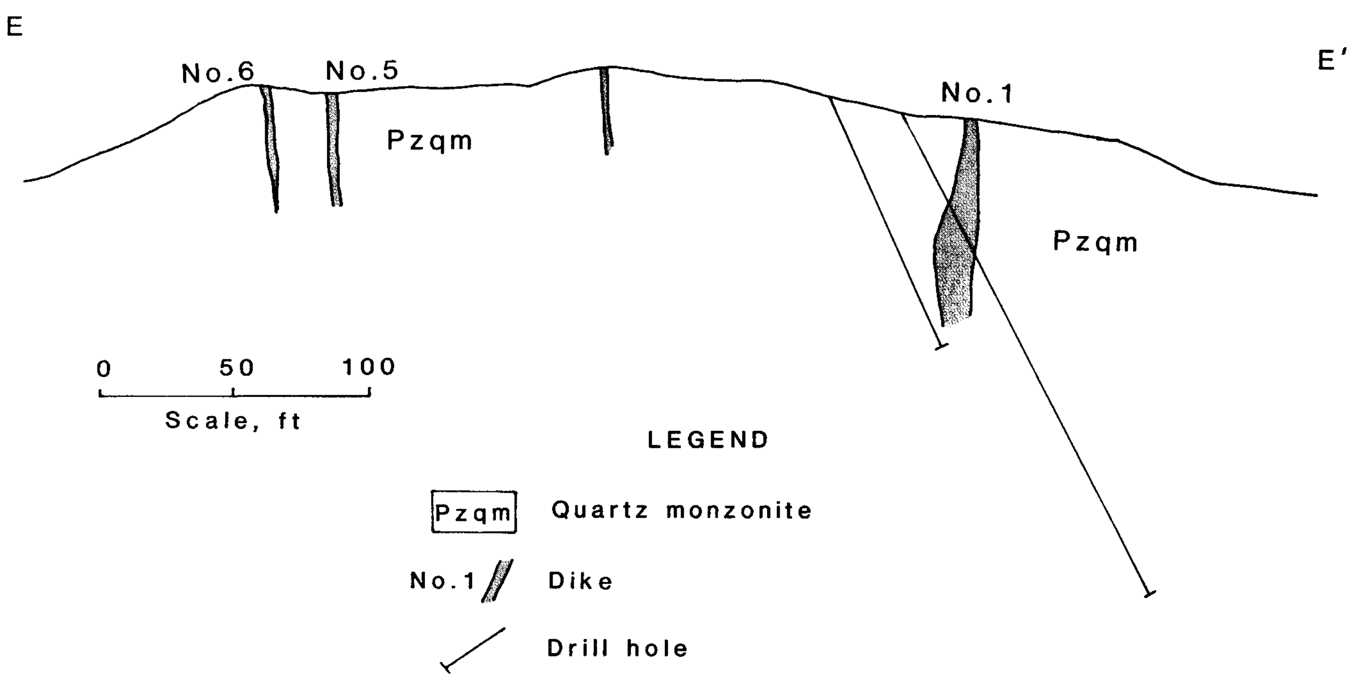


Figure 22 - Geologic cross section E-E', I and L prospect.

9/Analyses by Cheryl Mardock, geologist, Bureau of Mines, Albany, Oregon, and Jim Sjoberg, geologist, Bureau of Mines, Reno, Neveda.

pyrrhotite, rhodonite, calcite, epidote, riebeckite, fluorite, biotite, aegirine, pyrite, galena, sphalerite, rutile, and magnetite in addition to the columbium, REE, and radioactive minerals listed in table 20. Figure 23 are SEM images showing some of these minerals.

Sampling

Sample results indicate a wide range of metal values are present in the dikes (table 21 and appendix B see also head assays appendix C). Columbium concentrations in the I and L No. 1 dike correlate positively to high concentrations of radioactive elements, especially uranium; the highest columbium value (2.8 pct) was obtained in sample 11-6 which also contained 0.68 pct Th and 5.5 pct U. Columbium concentrations are highest in the southern segment of the northern splay of the No. 1 dike, especially in the area between samples 11-7 and 11-21, where the dike averages approximately 1,300 ppm Cb as well as 973 ppm Th and 821 ppm U over 5.2 ft. In contrast, a southern splay of the No. 1 dike, between samples 11-22 and 11-25 (fig. 19), averages approximately 670 ppm Cb, but less than 200 ppm for uranium and thorium, each, over a 3.0 ft. width.

The No. 1 dike also contains locally elevated values of beryllium (up to 2,000 ppm), gallium, lead, palladium, tin, tantalum, and zinc. Elevated gallium concentrations approximately correlate with higher concentrations of lead, nine samples containing high lead concentrations also contained detectable quantities of gallium with a high value of 90 ppm and an average of 40 ppm for those samples. Palladium (one sample analyzed) was also detected in sample 11-6 (140 ppb Pd). Tantalum (all samples were analyzed) was detected in five samples with a high value of 400 ppm (sample 11-16).

Dikes 2 through 6 are similarly mineralized although widths are generally much less. With individual sample analyses recalculated to minimum mining width of 3.0 ft, dike Nos. 3, 5, and 6 contain an average of approximately 700 ppm Cb. Dike No. 3 also averages 400 ppm Th. Two samples of dike No. 4 average approximately 2,100 ppm Cb and 232 ppm U over 4.0 ft. One sample of dike No. 2 contained 450 ppm Th and 76 ppm U, but less than 50 ppm Cb. A few of the samples with higher columbium, uranium, or thorium concentrations also contained very high concentrations of light REE and zirconium.

Trace amounts of beryllium, gold, tin, and tantalum were also detected in some samples collected from dike Nos. 2, 3, 4, 5, and 6. Tantalum was detected in six samples; higher values (to 200 ppm Ta) are associated with higher tin values (to 251 ppm Sn). Beryllium was detected in three samples; concentrations ranged between 310 and 1,200 ppm Be.

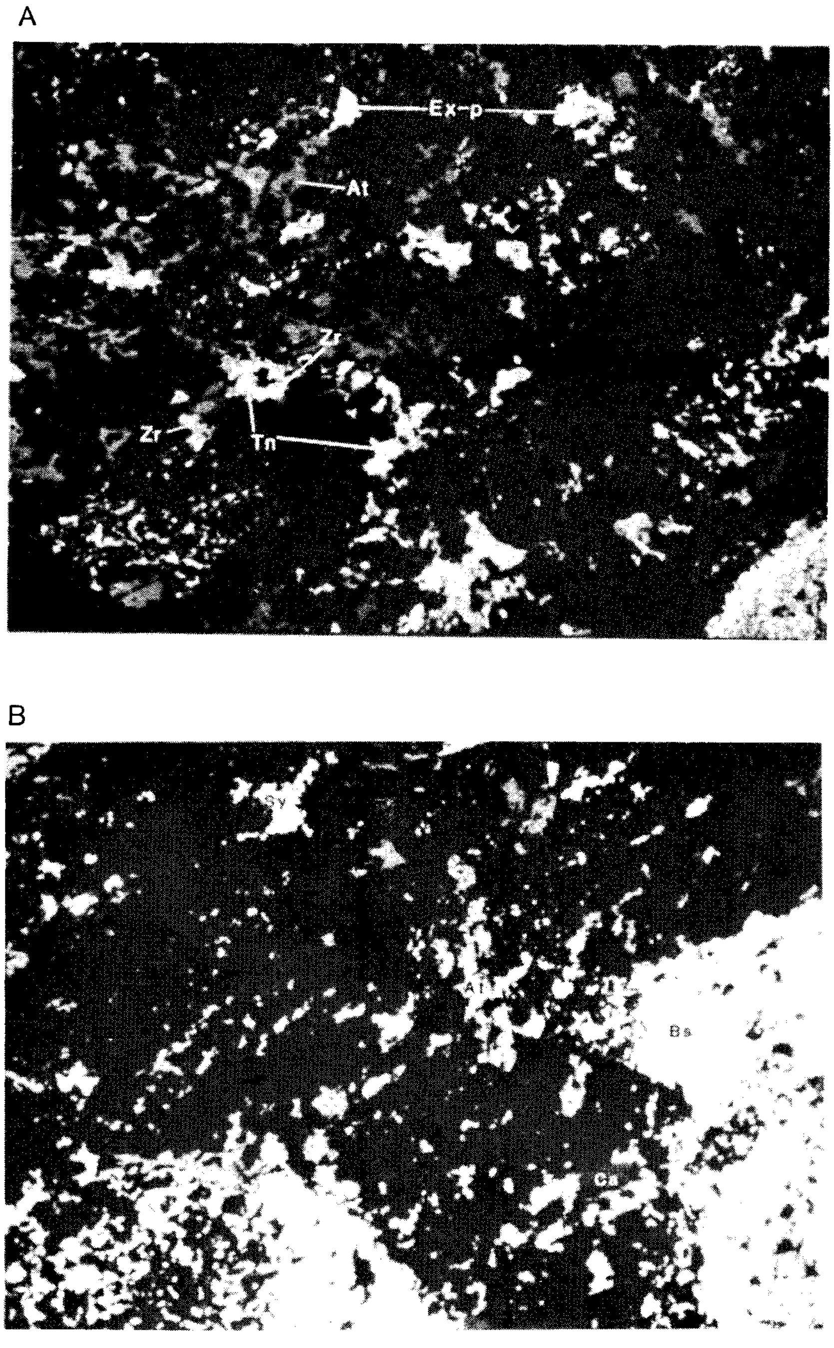


Figure 23 - Radioactive dikes at Bokan Mountain generally contain fine to medium grain Cb-REE-Zr minerals suspended in a martrix of quartz and Na-feldspar.
A. SEM backscatter image of subrounded quartz grains (black) which are surrounded by a matrix composed mostly of euxinite and polycrase (Ex-P), thalenite (Tn), and zircon (Zr) and allanite (At) gray-colored minerals.
B. Masses of bastnaesite ? (Bs), allanite (At), and synchysite (Sy), in a dark matrix of quartz, feldspar, and calcite (Ca).

TABLE 20. - SEM identification of REE-columbium-radioactive minerals in the I and L and Dotson dike prospects

REE MINERALS	*Thalenite $Y_3Si_3O_{10}(OH)$
	Tengerite $CaY_3(CO_{34}(OH)_3.3H_2O$
	*Bastnaesite $(Ce,La)CO_3F$
	Parisite $Ca(Y,Ce)_2(CO_3)_2F$
	Synchysite $CaCe(CO_3)_2F$
	Unnamed REE fluorocarbonate mineral
	*Allanite $(Ca,Ce)_2(Al,Fe)_3(SiO_4)_3(OH)$
	Monazite $(Ce,La)PO_4$
	Xenotime YPO_4
Cb MINERALS	*Euxenite-Polycrase Series $(Y,Ca,Ce,U,Th)(Cb,Ta,Ti)_2O_6$
	Columbite $(Fe,Mn)(Cb,Ta)_2O_6$
	Samarskite $(REE,U,Th,Ca,Fe,Pb)(Cb,Ta,Ti)_2O_6$
	Fergusonite $(Y,Er,Ce,U)(Cb,Ta)O_4$
	Aeschynite $(Ce,Ca,Fe,Th)(Cb,Ti)_2(O,OH)_6$
U-Th MINERALS	*Thorite $ThSiO_4$
	Uranothorite $(U,Th)SiO_4$

*Most Abundant

TABLE 21. - Analyses[1] of samples collected at the I and L prospect.

Sample	Type	Width (ft)	Analyses, ppm except as noted: Cb	Th	U	Y	Zr pct	Rare-Earth-Elements: La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE 2/
11-1...	Ch	11.0	L	1115	255	100	0.10	90	L	L	L	L	L	L	L	L	L	L	L	20	L	110
11-2...	Ch	4.0	224	4420	2020	400	0.04	20	L	L	L	L	L	L	L	L	L	L	L	100	L	120
11-3...	Ch	11.0	217	1410	3840	4000	0.03	400	L	L	L	L	L	L	L	1000	300	1000	L	1000	200	3900
11-4...	CR		476	6215	8600	4000	0.01	L	2000	L	L	L	L	500	L	1000	200	1000	90	500	L	5740
11-5...	Ch	8.5	L	175	115	20000	0.40	L	L	L	1000	L	L	1000	L	2000	500	5000	400	2000	L	11900
11-6...	Ch	0.2	28000	6800	55300	9000	4.10	200	L	L	1000	L	L	L	L	L	L	L	L	500	L	1700
11-7...	Ch	7.0	1050	240	1410	L	0.08	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
11-8...	Ch	3.0	L	30	6	100	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
11-9...	Ch	3.0	70	150	68	40	D	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
11-10..	Ch	2.5	770	1780	1240	200	0.30	90	L	L	L	L	L	L	L	L	L	L	L	50	L	140
11-11..	Ch	2.5	189	320	140	20	D	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
11-12..	Ch	18.0	L	135	11	L	0.10	90	L	L	L	L	L	200	L	L	L	L	L	L	L	290
11-13..	Ch	0.5	1050	210	425	200	L	900	L	L	L	L	L	L	L	L	L	L	L	L	L	1100
11-14..	Ch	0.5	3780	625	780	200	0.40	900	1000	L	1000	L	L	L	L	L	L	L	L	50	L	2950
11-15..	C	14.0	1820	300	1030	100	0.20	40	L	L	L	L	L	L	L	L	L	L	L	L	L	40
11-16..	G		13300	600	9030	20	4.60	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L

Descriptions

Sample	Description
11-1...	Quartz-albite altered zone in granite; 1,000-13,000 cps.
11-2...	Locally sheared, hematite- and limonite-stained quartz-albite pegmatite and albitic aplite; 2,300-27,000 cps. High radioactivity corresponds to zones of iron staining.
11-3...	Zone includes iron-stained albitic pegmatite, sheared quartz veins, and a green-colored granitic rock with disseminated galena and secondary uranium minerals on fractures.
11-4...	Specimen of finely crystalline green-colored albite and aegirine (?) granitic rock from sample 11-3.
11-5...	Quartz-albite-altered and locally iron-stained granite; 600-1,700 cps.
11-6...	Dark-colored uraninite (?)-bearing vein; 30,000 cps.
11-7...	Wallrock to 11-6 consists of limonitic albite-altered granitic rock; 6,000-20,000 cps.
11-8...	Limonite-stained and fractured granite; 1,000 cps.
11-9...	Adjacent to 11-8. Quartz-albite altered granite; 2,500 cps.
11-10..	Quartz-albite pegmatite adjacent to 11-9; 2,200 cps.
11-11..	Iron-stained and quartz-albite-altered granite adjacent to 11-10; 7,000 cps.
11-12..	Complex zone of high radioactivity (1,000-16,000 cps) consisting of aplite dikes up to 0.4-ft-thick and irregular aplite zones up to 2.0-ft-thick with irregular quartz-albite pegmatites up to 1.0-ft-thick and abundant iron staining.
11-13..	Quartz-albite pegmatite from 11-12; 800-9,000 cps.
11-14..	Iron-stained highly altered aplite and irregular quartz vein from 11-12.
11-15..	Complex zone containing irregular pegmatitic and aplitic dikes and sheared limonitic granitic rock.
11-16..	Specimen of most radioactive material from 11-15. Shows fine-grained intrusive texture with abundant dark-colored inclusions and pervasive limonite staining; 28,000 cps.

TABLE 21. - Analyses[1] of samples collected at the I and L prospect. - continued

Sample	Type	Width (ft)	Analyses, ppm except as noted																			
								Rare-Earth-Elements														Total REE [2]
			Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	
11-17..	C	4.5	2940	230	850	100	0.60	L	L	L	L	L	L	L	L	L	L	L	L	100	L	100
11-18..	CR		L	565	21	100	L	L	L	L	L	L	L	L	L	L	L	L	L	50	L	50
11-19..	Ch	2.2	980	4660	885	200	0.70	L	L	L	L	L	L	L	L	L	L	L	L	100	L	100
11-20..	Ch	2.6	2310	2930	956	100	0.50	L	L	L	L	L	L	L	L	L	L	L	L	50	L	50
11-21..	C	0.5	L	7830	1150	200	D	L	L	L	L	L	L	L	L	L	L	L	L	50	L	50
11-22..	C	0.8	3360	665	678	100	0.30	400	L	L	L	L	L	L	L	L	L	L	L	50	L	450
11-23..	Ch	3.5	840	L	245	40	1.00	200	L	L	L	L	L	L	L	L	L	L	L	L	L	200
11-24..	Ch	2.0	L	130	27	L	0.40	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
11-25..	Ch	0.8	1050	490	180	40	0.40	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
11-26..	Ch	1.7	280	485	63	40	0.40	L	L	L	1000	L	L	L	L	L	L	L	L	L	L	1000
11-27..	C	3.0	L	450	76	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
11-28..	CR		80	1925	120	400	0.20	L	L	L	1000	L	L	L	L	L	L	L	L	100	L	1100
11-29	Ch	2.0	L	35	4	20	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
11-30..	Ch	3.8	609	465	116	20	0.02	90	L	L	L	L	L	L	L	L	L	L	L	L	L	90
11-31..	Ch	6.0	840	410	123	100	0.02	200	L	L	L	L	L	L	L	L	L	L	40	50	L	90
11-32..	Ch	1.9	2520	630	428	400	0.04	40	L	L	1000	L	L	L	L	L	L	L	L	L	L	1040
11-33..	C	2.0	1120	575	149	40	0.50	90	L	L	L	L	L	L	L	L	L	L	L	L	L	L

Descriptions

11-17..	Mix of milky quartz and albitic aplite; 2,000-9,000 cps.
11-18..	Wallrock to 11-17. Albitized quartz monzonite; 3,200 cps.
11-19..	Iron-stained quartz monzonite with quartz albite pegmatitic stringers.
11-20..	Iron-stained quartz monzonite with quartz albite pegmatitic stringers.
11-21..	Quartz-albite pegmatite.
11-22..	Quartz-albite pegmatite.
11-23..	Quartz-rich pod with 10% albite, contains an unidentified black mineral along selvages.
11-24..	Discontinuous 1-ft-wide albite-rich zone of high radioactivity (+20,000 cps), separated from 11-23 by 2 ft of chloritic country rock.
11-25..	Quartz-albite pegmatite.
11-26..	Adjacent to 11-25. Quartz-albite-altered quartz monzonite.
11-27..	0.5-ft-wide quartz-albite pegmatite and iron-stained quartz monzonite.
11-28..	Iron-stained aplite; 5,000 cps.
11-29..	Quartz-albite altered granite.
11-30..	Quartz-albite altered granite with quartz lenses.
11-31..	Albite-quartz-altered granite.
11-32..	Limonitic milky quartz with 20% albite; 5,000 cps.
11-33..	Quartz-albite pegmatite with albite-rich selvage; 1,600 cps on pegmatite, 7,800 cps on selvage.

TABLE 21. - Analyses[1] of samples collected at the I and L prospect.- continued

Sample	Type	Width (ft)	Analyses, ppm except as noted					Rare-Earth-Elements														Total REE[2]
			Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	
11-34..	Ch	1.0	168	30600	1335	400	0.30	300	L	L	1000	L	L	200	L	500	L	L	L	L	L	2000
11-35..	Ch	0.5	L	139000	3875	900	0.10	2000	9000	2000	20000	L	200	2000	L	5000	200	L	L	L	L	40400
11-36..	C	4.2	1330	70	169	100	0.05	200	L	L	L	L	L	L	L	L	L	L	40	50	L	290
11-37..	C	3.8	2940	L	295	40	0.40	400	L	L	L	L	L	L	L	L	L	L	40	200	L	640
11-38..	Ch	0.4	4620	125	945	100	2.00	2000	2000	L	5000	L	L	500	L	L	L	L	L	L	L	9500
11-39..	C	0.9	2100	50	260	100	0.60	200	L	L	1000	L	L	500	L	L	L	L	L	L	L	1700
11-40..	Ch	0.9	4270	360	560	100	2.00	300	L	L	L	L	L	L	L	L	L	L	L	L	L	300
11-41..	C	3.3	1260	L	170	20	0.20	90	L	L	L	L	L	L	L	L	L	L	L	L	L	90
11-42..	Ch	0.8	910	340	195	200	3.00	2000	2000	L	L	L	L	500	L	L	L	L	L	L	L	4500
11-43..	Ch	0.3	1470	300	420	4	2.00	200	L	L	L	L	L	L	L	L	L	L	L	L	L	200
11-44..	Ch	0.9	2240	130	305	200	0.60	2000	2000	L	5000	L	L	500	L	L	L	L	L	L	L	9500
11-45..	Ch	0.7	1610	115	255	40	L	40	1000	L	1000	L	L	L	L	L	L	L	L	L	L	2040
11-46..	Ch	3.5	413	35	22	L	0.04	L	2000	L	L	L	L	L	L	L	L	L	L	L	L	2000
11-47..	Ch	0.5	1750	2520	533	400	D	200	L	L	L	L	L	L	L	L	L	L	L	L	L	200
11-48..	Ch	0.2	3220	35	500	100	1.00	200	L	L	L	L	L	L	L	L	L	L	L	L	L	200

C Channel sample. Ch Chip sample. D Detected. G Grab sample. - Not analyzed. L Less than detection limit.
CR Random chip sample.
[1]See table 4 for description of analytical methods and appendix for additional analyses.
[2]Estimates of "Total REE" include detection limit "D" values for elements detected near limits of quantification.

Descriptions	
11-34..	Albitic pegmatite with .5-ft-wide zone of heavy, iron-stained black sooty material on southeast side; 27,000 cps.
11-35..	Black sooty material from 11-34.
11-36..	0.4-ft-wide quartz-albite pegmatite and albite-altered quartz monzonite wallrock with small quartz-albite pegmatite stringers.
11-37..	Quartz-albite pegmatite and iron-stained wall rock.
11-38..	Quartz-rich pegmatite with black sooty mineral on fractures.
11-39..	Quartz-albite pegmatite with irregular zones of an unidentified black mineral and abundant iron-staining.
11-40..	Iron-stained quartz-albite pegmatite; 12,000 cps.
11-41..	Quartz pod in pegmatite.
11-42..	Quartz-albite pegmatite.
11-43..	Quartz-albite pegmatite with black irridescent mineral in selvage.
11-44..	Quartz-albite pegmatite with sheared pyrite and a black mineral.
11-45..	Iron-stained quartz-albite pegmatite with pyritic selvages.
11-46..	Quartz-rich pegmatite; 1,200 cps.
11-47..	Quartz pegmatite with iron staining on fractures; 6,500 cps. Separated from 11-46 by 1 ft of altered wall rock.
11-48..	Quartz-rich pegmatite with pyritic selvages; 2,500 cps.

Resources

Indicated and inferred columbium, uranium, and thorium resources can be estimated for all but dike No. 2, which only had one sample. Because of low or sporadic sample analytical values, no resources are calculated for yttrium, zirconium, or REE. Dike No. 1 contains columbium together with uranium and thorium resources in the southern portion of its northernmost splay (southeast of samples 13-6 and 13-7).

Indicated resources are estimated by multiplying the cross sectional areas of dike No. 1 to drill-indicated depths (measured from cross sections in figures 18 through 22) by the length of dike each cross section influences and applying a tonnage factor of 10.6, which is an average value between those for pegmatites and dikes (see table 5). A total of 21,000 st of rock contain indicated resources of:

55,000 lb Cb
41,000 lb Th
34,000 lb U

Similar methodology for dike No. 1's southern splay indicate 23,000 st to contain approximately 31,000 lb Cb but negligible resources of uranium and thorium. A small resource of beryllium is present, but was not estimated.

Indicated resources in dike Nos. 3 through 6 can also be estimated from cross section D (fig. 21), and using a tonnage factor of 11.4 for pegmatite. At a width of 3.0 ft, 50,000 st in dike Nos. 3, 5, and 6 are estimated to contain 70,000 lb Cb indicated columbium resources. At width of 4.0 ft, dike No. 4 contains indicated resources of 25,000 lb Cb in 6,000 st.

Additional inferred resources can also be calculated for all but dike No. 2 by assuming: 1) dikes continue at depth by an additional 50 pct of drill-indicated depth, 2) dikes continue along strike by an additional 25 pct of the known strike length, and 3) grade is the same as for the related zones of indicated tonnage. An inferred columbium resource is 73,000 lb Cb.

DOTSON PROSPECT

General Description

The Dotson prospect is located on the heavily forested southeastern flank of Bokan Mountain and includes the Carol Ann Nos. 1, 2, and 3 prospects described by MacKevett (3) (fig. 2 and 24). The prospect comprises a system of west-northwest-striking, steeply dipping radioactive dikes that can be traced between test pits and outcrops for approximately 7,000 ft from tidewater on Kendrick Bay north-westward to the 1,100-ft elevation of Bokan Mountain. Here they are cut by and probably displaced to the south from the I and L prospect dikes by the north-trending Dotson shear zone. The dikes likely extend southeastward offshore under the West Arm Kendrick Bay.

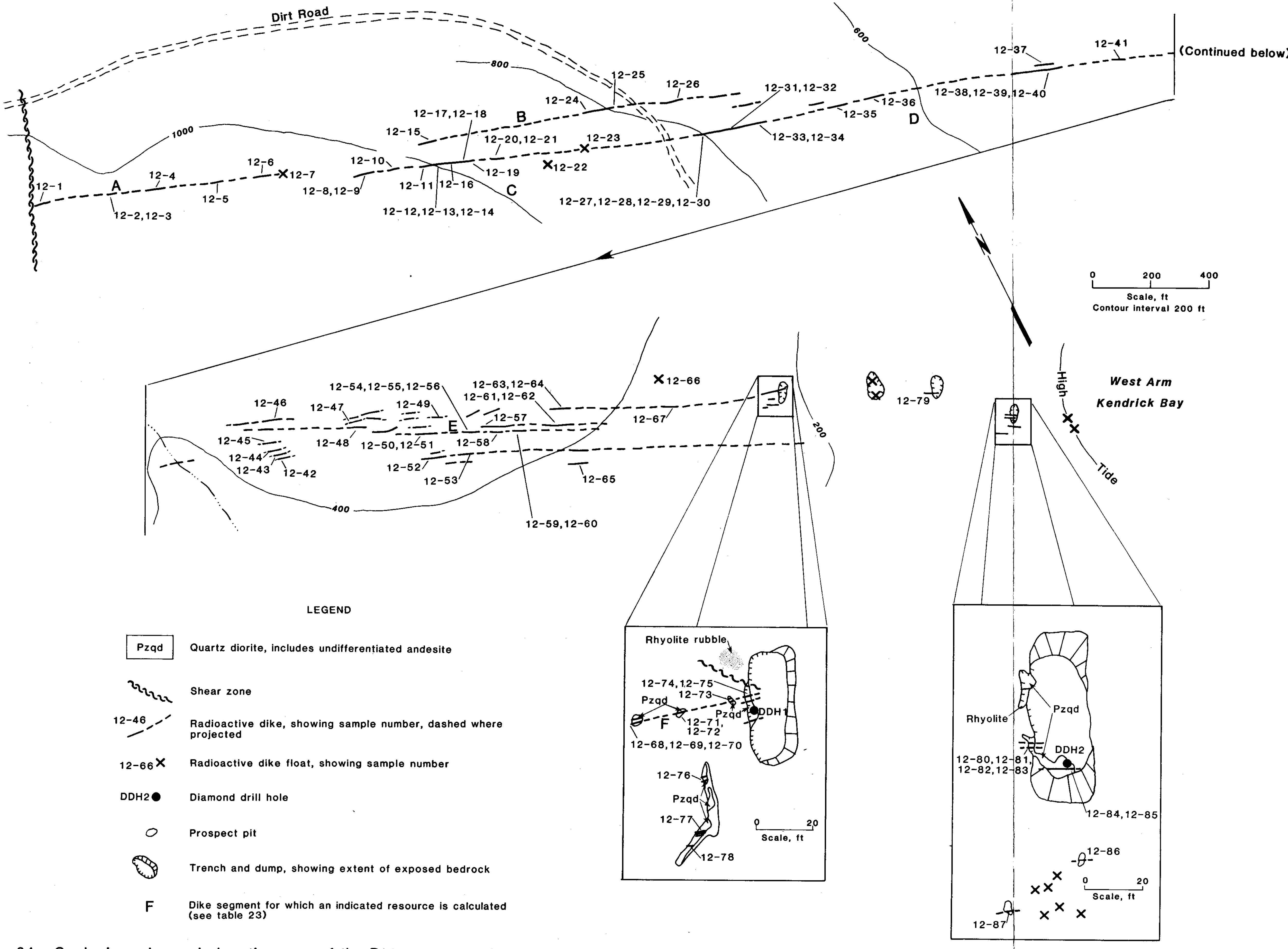


Figure 24 - Geologic and sample location map of the Dotson prospect.

The dikes vary in width along strike ranging from an average of approximately 0.6 ft in the southeastern portions to an average of 3.1 ft for the thickest dike in the northwestern portion. Generally, there are several dikes of varying widths present at any point along the system (fig. 25). At the northwestern end there appears to be only one or a few dikes over a narrow interval of less than 100 ft. At the southeastern end, however, a system of more numerous, thinner dikes occur over a width of approximately 200 ft. In addition, numerous, relatively thin dikes ranging from hairline to a few inches in width also locally occur as swarms over intervals as wide as 12.3 ft.

The dikes vary in texture along their strike length. To the northwest, they are generally pegmatitic with coarse quartz cores, veins of allanite, and selvages of albite, epidote, sulfides, and magnetite. Outward from the Bokan Mountain granite, however, the dikes generally have medium to fine-grained granular textures.

In thin section the dikes further from the granite are seen to consist largely of elliptical strained quartz grains in a matrix composed mostly of albite, quartz, zircon, and secondary columbium, REE, and radioactive minerals (fig. 26). The dikes show foliation parallel to their contacts represented by the alignment of strained quartz grains and the orientation of microfractures containing a wide variety of trace minerals.

Mineralization is generally confined to microfractures in dikes or to the interstices between larger silicite grains (17). The dominant radioactive mineral is allanite, which occurs as elongated reddish-brown crystals and irregular aggregates, however, traces of thorite have also been identified and uranothorite, uraninite, and britholite have been reported (6). SEM studies by the Bureau (table 20) indicate that REE are predominantly contained within fluorocarbonate minerals, bastnaesite, parisite, and synchysite, and an unnamed fluorocarbonate higher-Ca member, but are also present in monazite and allanite. Yttrium is largely contained in thalenite or its alteration product tengerite, but is also present in xenotime. Columbium-bearing minerals in the euxinite-polycrase series have also been identified by SEM studies. Pyrochlore has also been reported (6), but were not observed during this investigation.

Sampling

A total of 87 samples were collected at the prospect (table 22). In addition head assays for three bulk samples from the Dotson prospect are listed in appendix C. Samples of dike material contain appreciable concentrations of columbium, thorium, uranium, yttrium, zirconium, and REE, as well as traces of numerous other metals. For all samples the weighted average grade is approximately 774 ppm Cb, 488 ppm Th, 104 ppm U, 1,165 ppm Y, 0.21 pct Zr, and 1,920 ppm REE over 2.8 ft of the dike and wall rock (table 22). Thirty-three of the samples contained only dike material with widths ranging between 0.1 and 3.5 ft and averaging approximately 1.1 ft. Higher concentrations of all metals are generally found in the southeastern portion of the Dotson dikes. Samples of dike material collected southeast of the creek and above the 200-ft elevation average 1,690 ppm Cb, 176 ppm U, 2,421 ppm Y, 0.40 pct Zr, and 4,260 ppm REE, but only 293 ppm Th over a width of 0.9 ft (see also head assays from this area of the dike, appendix C which average 0.223 % Cb and 0.76 % Y). Columbium concentrations in samples positively correlate with uranium concentrations and higher uranium to thorium ratios.

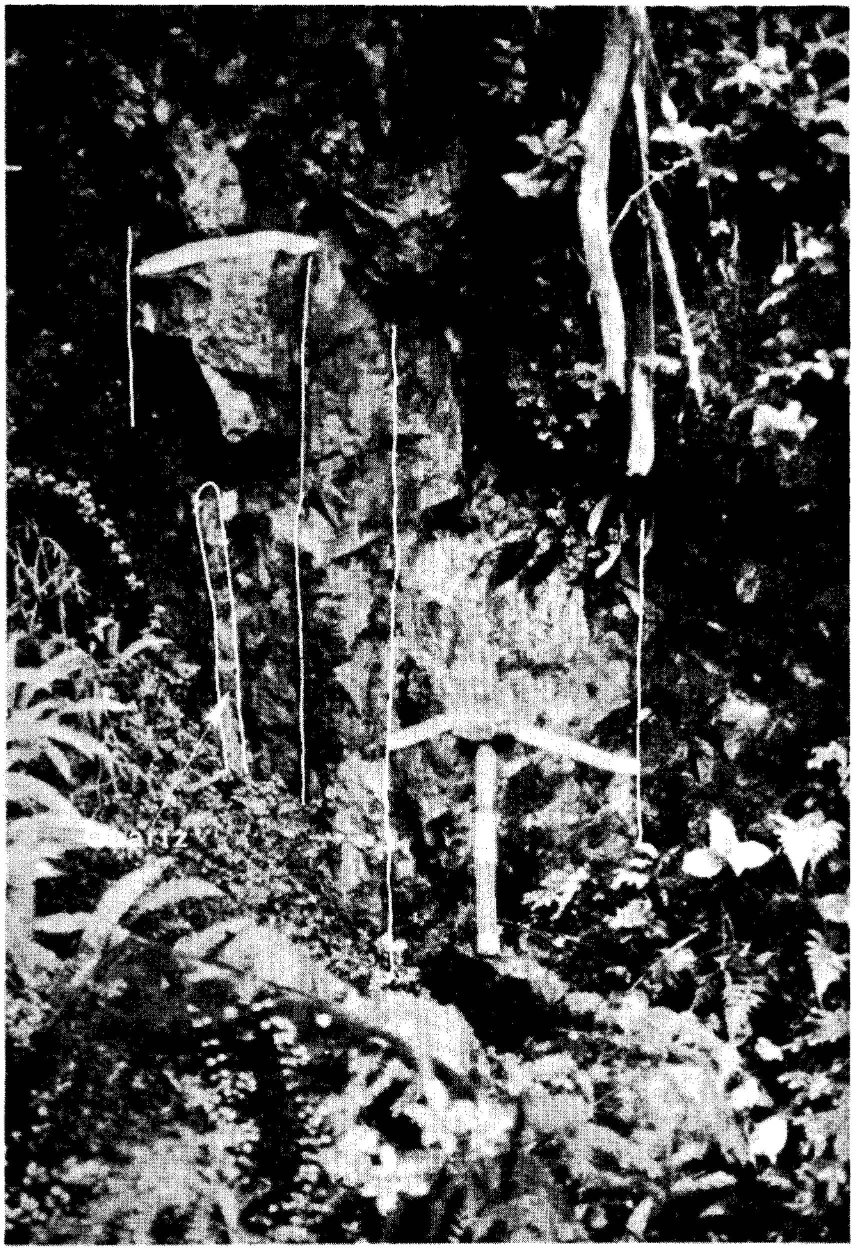
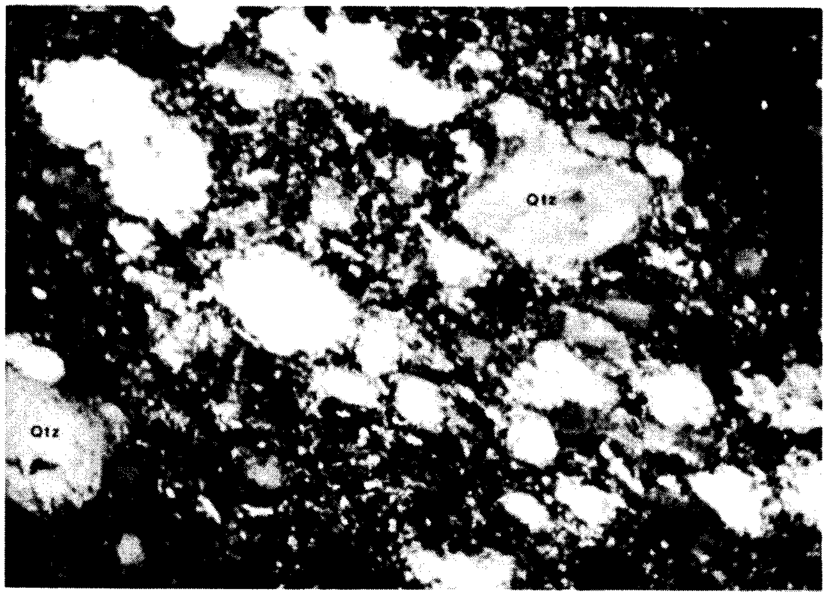


Figure 25 - Photograph of the Dotson dike.

A



B

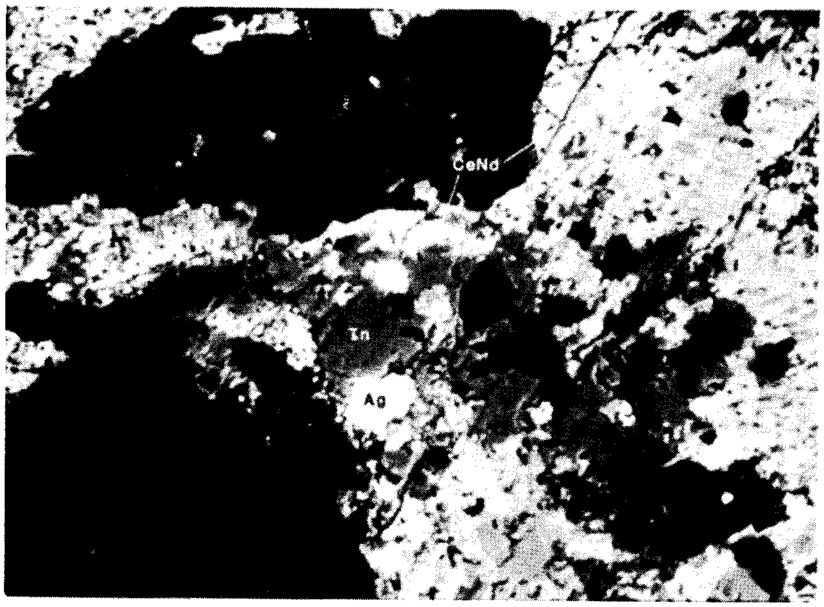


Figure 26 - Photomicrograph and backscatter SEM image of samples from the Dotson prospect.
A. Photomicrograph showing eliptical strained quartz grains (gray mineral) in matrix composed of mixture of quartz, albite, zircon, and secondary columbium, REE, and radioactive minerals. Polarized light, field of view is 1 mm.
B. Thalanite (Th), a Ce Nd mineral (CeNd) probably parisite, with Na feldspar and quartz (black areas). Rare to trace grains of precious metals (Ag) occur within matrix of rare earth minerals.

TABLE 22. - Analyses[1] of samples collected from the Dotson dike system.

Sample	Type	Width (ft)	Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE
			Analyses, ppm except as noted					Rare-Earth-Elements														3/
12-1...	C	3.5	64	495	30	200	0.30	L	L	L	L	L	L	L	L	L	L	50	L	L	L	50
12-2...	C	2.0	840	200	48	900	0.40	200	2000	L	L	L	L	200	L	L	L	L	L	L	L	2400
12-3...	C	2.0	550	235	66	400	0.20	200	1000	L	1000	L	L	200	L	L	L	L	L	L	L	2400
12-4...	C	2.8	574	230	68	400	0.08	400	L	L	L	L	L	L	L	100	L	L	L	20	L	520
12-5...	Ch	3.0	490	85	97	400	0.10	200	L	L	L	L	L	L	L	L	L	L	L	50	L	250
12-6...	Ch	2.5	329	L	120	200	L	200	L	L	L	L	L	L	L	L	L	L	L	20	L	220
12-7...	G		105	440	20	900	0.60	L	L	L	L	L	L	L	L	200	L	L	L	200	L	400
12-8...	C	2.6	756	150	51	900	0.07	400	2000	L	L	L	L	L	L	100	L	L	L	50	L	2550
12-9...	C	3.3	308	330	27	200	0.02	200	L	L	L	L	L	L	L	L	L	L	L	20	L	220
12-10..	Ch	2.0	1260	385	124	900	0.10	400	2000	L	2000	L	L	200	L	200	L	L	L	100	L	4900
12-11..	C	0.6	1120	2360	160	4000	0.20	400	2000	L	2000	2000	L	200	L	500	200	L	L	500	L	8300
12-12	Ch	10.0	322	300	33	400	0.07	200	L	L	L	L	L	L	L	100	L	L	L	50	L	350
12-13..	Ch	0.6	322	530	96	900	1.00	200	L	L	L	L	L	L	L	200	L	L	L	100	L	500
12-14..	C	1.0	651	230	48	900	0.30	400	L	L	L	L	L	M	L	200	L	L	40	100	L	>740
12-15..	Ch	3.5	700	40	48	200	0.05	200	L	L	L	L	L	100	L	L	L	L	L	200	L	500
12-16..	Ch	5.2	448	920	81	400	0.40	200	L	L	L	L	L	L	L	L	L	L	L	50	L	250

Descriptions

Sample	Description
12-1...	Pegmatite.
12-2...	Pegmatitic dike with dark smokey quartz; 1,100-2,000 cps.
12-3...	Two quartz veins adjacent to sample 12-2; 1,000-2,200 cps.
12-4...	Quartz-albite dike with black siliceous bands; 1,000 cps.
12-5...	Quartz-albite dike with black siliceous bands; 1,000 cps.
12-6...	Quartz-albite dike with chlorite-altered quartz monzonite selvages; 1,600-3,500 cps.
12-7...	Quartz-albite pegmatite; 1,700 cps.
12-8...	Two thin (<.2-ft-wide) quartz-albite dikes in chlorite-altered quartz monzonite; 700-3,200 cps.
12-9...	Quartz-albite pegmatite; to 6,200 cps.
12-10..	Quartz-albite dike.
12-11..	Quartz-albite dike.
12-12..	Six dikes, 2-ft to 1.0-ft-wide over sampled width; 1,100-3,900 cps.
12-13..	Quartz-albite-pyrite-magnetite-hematite dike from sample 12-12 zone.
12-14..	Quartz-albite magnetic dike from sample 12-12 zone.
12-15..	Quartz-rich pegmatite in albite-chlorite-altered quartz monzonite; 1,200-2,000 cps.
12-16..	Interval with 5 dikes; 1,200-3,200 cps.

TABLE 22. - Analyses[1] of samples collected from the Dotson dike system.- continued

Sample	Type	Width (ft)	Analyses, ppm except as noted: Cb	Th	U	Y	Zr pct	Rare-Earth-Elements: La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE [3]
12-17..	Ch	4.0	315	745	39	900	0.40	400	L	L	L	L	L	L	L	200	L	L	40	200	L	840
12-18..	C	1.0	L	55	3	200	0.20	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
12-19..	C	6.8	420	2380	155	2000	L	400	L	L	L	L	L	L	L	200	L	L	40	200	L	840
12-20..	Ch	10.0	273	550	35	900	0.4	200	L	L	L	L	L	L	L	100	L	L	L	50	L	350
12-21..	Ch	2.0	840	430	38	200	0.04	90	L	L	L	L	L	L	L	L	L	L	L	20	L	110
12-22..	Ch	8.0	665	1540	105	900	0.09	200	L	L	L	L	L	200	L	L	L	L	L	100	L	500
12-23..	C	2.0	750	700	67	400	1.00	90	L	L	L	L	L	L	L	L	L	L	L	200	L	290
12-24..	C	6.7	1140	100	71	20	0.05	90	L	L	L	L	L	L	L	L	L	L	L	L	L	90
12-25..	C	2.3	1640	75	104	100	0.10	400	L	L	1000	L	L	L	L	L	L	L	L	L	L	1400
12-26[2].	C	1.7	2000	110	168	1400	0.36	856	1670	-	855	199	21	-	-	-	-	-	-	62	7	3734
12-27..	C	2.0	L	65	3	40	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
12-28..	C	1.7	231	1580	94	2000	0.30	400	L	L	L	L	L	200	L	500	100	L	90	50	L	1340
12-29..	Ch	3.3	140	295	26	200	0.01	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
12-30..	C	1.5	168	920	95	400	0.10	100	L	L	L	L	L	100	L	1000	100	1000	200	1000	L	3500

Descriptions

Sample	Description
12-17..	Interval with 3 dikes; 4,200-9,000 cps.
12-18..	1.0-ft-wide black siliceous zone in sample 12-17.
12-19..	Interval with 6 quartz-albite dikes; 2,700-9,300 cps.
12-20..	Interval with 8 dikes or pegmatites; 800-4,300 cps.
12-21..	Breccia sill with dike and aplite clasts.
12-22..	Massive float boulders with numerous 1/4- to 3-in-wide dikes; 6,000-16,000 cps.
12-23..	Float boulder containing 2 closely spaced .5-ft-wide dikes; 800-2,200 cps.
12-24..	Interval with 4 radioactive dikes; 400-1,400 cps.
12-25..	Interval with 2 dikes; to 2,000 cps.
12-26..	Interval with 5 quartz-rich dikes, 350-650 cps.
12-27..	Albite-chlorite altered quartz monzonite; 1,000 cps.
12-28..	Quartz-albite dike; 3,500 cps.
12-29..	Quartz monzonite with several thin quartz-albite dikes.
12-30..	Quartz-albite pegmatite with a black sooty mineral; 5,500 cps.

TABLE 22. - Analyses[1] of samples collected from the Dotson dike system.- continued

Sample	Type	Width (ft)	Analyses, ppm except as noted																			3/
								Rare-Earth-Elements														Total
			Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	REE
12-31..	Ch	0.8	567	1610	119	2000	0.40	200	2000	L	L	L	L	500	L	500	100	L	90	20	L	3410
12-32..	C	0.6	140	210	115	900	0.20	400	L	L	L	L	L	200	L	200	L	L	L	100	L	900
12-33..	Ch	2.5	224	750	94	2000	0.50	200	L	L	L	L	L	200	L	20	100	L	90	200	L	810
12-34..	Ch	2.5	364	505	65	L	0.10	90	L	L	L	L	L	L	L	200	L	L	L	L	L	2900
12-35..	Ch	3.0	644	380	68	L	0.10	200	L	L	L	L	L	L	L	100	L	L	L	L	L	300
12-36..	Ch	1.9	616	370	137	4000	0.20	90	L	L	1000	L	L	500	L	1000	200	1000	90	500	L	4380
12-37[2].	C	1.3	490	160	96	1100	0.88	481	986	-	479	107	13	-	-	-	-	-	-	82	11	2276
12-38..	Ch	1.5	126	35	13	40	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
12-39..	C	0.5	910	480	146	400	0.30	200	L	L	L	L	L	100	L	100	L	L	L	50	L	450
12-40..	Ch	1.5	L	30	3	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
12-41..	Ch	0.9	560	400	77	400	0.20	200	L	L	L	L	L	L	L	100	L	L	L	50	L	350
12-42[2].	H	0.1	1200	190	186	5500	1.20	652	1800	-	574	154	20	-	-	-	-	-	-	358	44	3785
12-43[2].	Ch	0.3	1900	120	154	4600	0.47	892	2500	-	1010	322	414	-	-	-	-	-	-	157	18	5313
12-44[2].	Ch	0.3	2800	430	239	7300	1.10	1230	3300	-	1140	355	44	-	-	-	-	-	-	286	33	6438

Descriptions

Sample	Description
12-31..	Quartz-albite dike; 2,000 cps.
12-32..	Quartz-albite dike; 2,000 cps.
12-33..	Albite-altered quartz monzonite wallrock to sample 12-32; 1,000-2,000 cps.
12-34..	Albite-altered quartz monzonite with .5-ft-wide quartz-albite dike; 800-1,000 cps.
12-35..	Quartz-albite dike with albite-altered quartz monzonite selvages; 800-1,200 cps.
12-36..	Quartz-albite dike with albite-altered quartz monzonite selvages; 800-1,200 cps.
12-37..	Interval with 5 quartz-rich pegmatites; 1,200 cps.
12-38..	Albite-altered quartz monzonite wallrock to sample 12-39; 200-450 cps.
12-39..	Quartz-albite dike; 1,300 cps.
12-40..	Albite-altered quartz monzonite wallrock to sample 12-39 opposite sample 12-38; 300 cps.
12-41..	Quartz-albite pegmatite; 860 cps.
12-42..	Fine-grained dike and 1/4-in-wide wall rock selvage; 5,000 cps.
12-43..	Quartz-albite dike and altered wall rock; 4,000 cps.
12-44..	Tan, fine-grained granular dike with minor quartz and carbonate clots; 8,000 cps.

TABLE 22. - Analyses[1] of samples collected from the Dotson dike system. - continued

Sample	Type	Width (ft)	Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE [3]
			Analyses, ppm except as noted					Rare-Earth-Elements														
12-45[2].	C	0.8	1300	99	144	1400	0.38	752	1450	-	556	150	25	-	-	-	-	-	-	63	9	3005
12-46[2].	C	0.5	1900	78	75	3300	0.34	641	1880	-	672	204	26	-	-	-	-	-	-	122	13	3558
12-47[2].	Ch	1.6	2500	160	180	3700	0.79	409	1070	-	522	145	21	-	-	-	-	-	-	216	25	2408
12-48[2].	Ch	1.0	1500	130	136	3200	0.32	738	1970	-	993	286	35	-	-	-	-	-	-	108	12	4143
12-49[2].	Ch	0.3	3400	410	255	7900	1.00	2450	4520	-	1830	512	72	-	-	-	-	-	-	300	36	9720
12-50..	C	0.7	1750	1085	320	4000	0.10	900	5000	L	2000	L	L	500	L	500	100	L	40	200	L	9240
12-51..	C	12.3	721	320	80	400	0.04	200	L	L	L	L	L	L	L	200	L	L	L	50	L	450
12-52[2].	Ch	0.4	1100	310	178	4800	0.69	737	1600	-	620	166	21	-	-	-	-	-	-	258	33	3435
12-53[2].	Ch	0.6	2700	410	217	7700	0.36	1460	4530	-	1190	391	52	-	-	-	-	-	-	221	23	7867
12-54[2].	C	0.3	4800	670	417	11000	1.60	1910	4530	-	2020	700	92	-	-	-	-	-	-	480	58	9946
12-55[2].	Ch	1.5	860	97	97	1700	0.24	333	850	-	541	132	16	-	-	-	-	-	-	69	8	2566
12-56[2].	C	1.4	830	200	121	2600	0.46	431	1040	-	584	147	18	-	-	-	-	-	-	110	12	2292
12-57..	C	1.2	1890	345	165	200	0.09	200	L	L	1000	L	L	200	L	200	L	L	L	50	L	1650
12-58..	C	0.3	3290	830	320	100	0.40	400	5000	L	2000	L	L	500	L	500	100	L	40	100	L	8640
12-59[2].	C	0.5	4100	470	436	11000	1.20	3080	2540	-	4160	1100	133	-	-	-	-	-	-	373	44	11430
12-60[2].	C	1.1	330	48	47	640	0.09	226	549	-	352	68	8	-	-	-	-	-	-	27	3	1237

Descriptions	
12-45..	Interval with 2 quartz-albite dikes.
12-46..	Interval with 2 equigranular, fine-grained dikes with local coarse quartz in core; 800 cps.
12-47..	Numerous thin dikes in interval; to 1,100 cps.
12-48..	Interval with 2 fine-grained dikes with local coarse quartz in core; 800 cps.
12-49..	Fine-grained dike; 800 cps.
12-50..	Quartz-albite dike; 4,000 cps.
12-51..	Outcrop with >20 thin dikes of .1-8-in-width, including dike of sample 12-50.
12-52..	Interval with 2 dark brown to beige fine-grained dikes.
12-53..	Interval with 3 dikes and 3-in of wallrock; 550 cps.
12-54..	Quartz-albite dike.
12-55..	Altered quartz monzonite and numerous dikes from south of 12-54.
12-56..	Altered quartz monzonite and numerous dikes from north of 12-54.
12-57.	Dike and altered quartz monzonite; 3,000-4,000 cps.
12-58..	One of several dikes in outcrop; 1,500 cps.
12-59..	Dike with abundant pink-colored, possibly zirconium, mineral.
12-60..	Wallrock to 12-59, 5 inches from south and 8 inches from north.

TABLE 22. - Analyses[1] of samples collected from the Dotson dike system. - continued

Sample	Type	Width (ft)	Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE 3/
			Analyses, ppm except as noted					Rare-Earth-Elements														
12-61[2].	C	0.5	2000	400	290	8100	0.79	2420	5930	-	3160	800	101	-	-	-	-	-	-	249	30	12589
12-62[2].	Ch	1.6	130	16	13	220	0.40	73	169	-	78	20	3	-	-	-	-	-	-	10	1	354
12-63[2].	Ch	8.0	1200	99	118	2000	0.23	769	1740	-	929	209	24	-	-	-	-	-	-	75	8	3754
12-64..	H	0.2	2660	750	255	4000	0.20	2000	9000	1000	1000	2000	L	1000	L	1000	200	L	40	200	L	17440
12-65[2].	Ch	0.6	1100	340	99	2800	0.39	558	1350	-	465	153	22	-	-	-	-	-	-	136	17	2700
12-66..	G		L	495	275	9000	0.09	2000	9000	2000	10000	L	L	1000	L	1000	200	1000	90	500	L	26790
12-67..	C	1.2	2450	335	365	400	0.09	400	1000	L	1000	L	L	20	L	200	L	L	L	20	L	2640
12-68..	Ch	4.5	910	725	315	400	0.09	400	L	L	L	L	L	200	L	200	L	L	L	50	L	850
12-69..	C	0.5	3430	475	585	2000	0.80	2000	9000	L	5000	L	L	500	L	500	100	L	L	100	L	17200
12-70..	C	1.0	1050	2610	740	20000	1.00	4000	20000	2000	20000	5000	200	2000	L	2000	200	1000	200	500	L	56600
12-71..	C	1.2	2800	345	355	900	0.05	900	L	1000	2000	L	L	500	L	200	L	L	L	50	L	3650
12-72..	C	1.5	L	65	9	40	L	200	L	L	L	L	L	L	L	L	L	L	L	L	L	200
12-73[2].	C	3.0	1900	240	371	3700	0.39	2190	4520	-	2020	531	57	-	-	-	-	-	-	107	11	9435
12-74[2].	C	2.0	470	71	77	450	0.06	355	716	-	321	81	9	-	-	-	-	-	-	22	3	1507
12-75[2].	C	1.0	5900	380	542	7300	0.74	4030	7760	-	3870	1000	123	-	-	-	-	-	-	241	25	17049
12-76[2].	C	2.0	880	280	184	2200	0.30	2000	4550	-	2340	486	50	-	-	-	-	-	-	83	8	9517

Descriptions

Sample	Description
12-61..	Pegmatitic dike.
12-62..	Chlorite-altered quartz monzonite from hanging wall and footwall of 12-61.
12-63..	Interval with 12 dikes totaling approximately 10 inches of width within chloritic quartz monzonite wallrock.
12-64..	One dike in interval of 12-63.
12-65..	Interval with 2 dikes; 600-1,000 cps.
12-66..	Dike in rubble.
12-67..	Dike with .4-ft-wide quartz core.
12-68..	Dike interval with 2 dikes and altered quartz diorite.
12-69..	Dike in 12-68 with quartz core and fine-grained selvage; 1,500 cps.
12-70..	Medium-grained granular dike with brown and red bands and disseminated pyrrhotite within 12-68 interval; 7,500 cps.
12-71..	Granular dike; 2,500 cps.
12-72..	Altered andesite and quartz diorite from wallrock to 12-71; 1,000 cps.
12-73..	Interval contains 2 wider (.6 and .4-ft-wide) and numerous thinner dikes with coarse quartz-fluorite core; 1,000-4,800 cps.
12-74..	Epidote-chlorite-magnetite-pyrite-pyrrhotite-altered andesite (?) from hangingwall and footwall to 12-75.
12-75..	Dike with central veinlet of quartz, fluorite, carbonate, and galena.
12-76..	Interval with 4 dikes in altered quartz diorite; to 1,800 cps.

TABLE 22. - Analyses[1] of samples collected from the Dotson dike system. - continued

Sample	Type	Width (ft)	Analyses, ppm except as noted Cb	Th	U	Y	Zr pct	Rare-Earth-Elements La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE [3]
12-77[2].	C	1.4	1400	300	179	4600	0.53	3000	7230	-	3520	786	76	-	-	-	-	-	-	116	11	14740
12-78[2].	C	0.2	3500	130	154	2500	0.39	1460	2900	-	1470	326	36	-	-	-	-	-	-	84	9	6285
12-79..	G	0.8	560	720	296	5800	0.89	4450	9050	L	3990	1100	105	L	L	L	L	L	L	144	16	18855
12-80	Ch	0.8	L	70	3	900	L	900	2000	1000	1000	L	L	200	L	200	L	L	L	50	L	5350
12-81..	Ch	0.8	623	280	130	L	0.01	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
12-82..	Ch	0.4	721	415	100	400	0.02	200	1000	L	L	L	L	L	L	L	L	L	L	L	L	1200
12-83..	Ch	1.0	539	520	215	900	L	900	2000	1000	1000	L	L	L	L	200	L	L	L	100	L	5200
12-84[2].	C	1.1	20	1	1	L	L	7	21	-	10	3	1	-	-	-	-	-	-	2	L	44
12-85[2].	C	0.4	460	160	119	4600	0.41	2810	5290	-	2140	674	78	-	-	-	-	-	-	145	15	11152
12-86[2].	Ch	0.1	2000	820	244	6500	1.00	2130	4150	-	1950	456	61	-	-	-	-	-	-	320	43	9110
12-87[2].	Ch	0.4	1300	510	279	6400	0.80	5410	10400	-	5110	1100	109	-	-	-	-	-	-	146	15	22290

Ch Chip sample. C Channel sample. G Grab sample. H High grade sample. - Not analyzed. D Detected. L Less than detection limit. M Major concentration detected.

[1]See table 4 for description of analytical methods and appendix for additional analyses.

[2]Sample analyzed at a commercial laboratory.

[3]Estimates of "Total REE" include detection limit "D" values for elements detected near limits of quantification. All 1986-1987 REE values are minimum-only due to self-shielding effect during neutron-activation analysis of samples with REE concentrates; 1986-1987 analyses also do not include values for Pr, Gd, Tb, Dy, Ho, Er, and Tm.

Sample	Descriptions
12-77..	Interval with 3 dikes in altered diorite; 200-1,200 cps.
12-78..	Dike with coarse quartz and pink and green-colored minerals; 350 cps. Sample includes .5-inches of altered diorite wallrock from each margin.
12-79..	Blackish-gray siliceous dike material with blebs of quartz and cross-cutting black veinlets.
12-80..	Fluorite-chlorite-altered quartz monzonite wallrock to 12-81.
12-81..	Dike, abundant fluorite.
12-82..	Dike, abundant fluorite.
12-83..	Dike adjacent to 12-82; 4,800 cps.
12-84..	Footwall to 12-85.
12-85..	Brown, fine-grained granular dike and minor altered quartz diorite wallrock.
12-86..	Granular dike; 700 cps.
12-87..	Banded dike; 700 cps.

The average of 10 samples of altered wall rock from adjacent to the dikes is 176 ppm Cb, 200 ppm Th, 35 ppm U, 840 ppm Y, and 400 ppm REE, but only traces of zirconium. This indicates that mineralization, excepting zirconium, is also present as an enrichment halo in wall rocks adjacent to the dikes.

The dikes at the Dotson prospect contain trace to major concentrations of numerous other metals (appendix B). Samples of dikes contain up to 1,600 ppm Be, 40 ppm Ga, 90 ppm Ge, 220 ppm Hf, 6,000 ppm Pb, 0.24 ppm Pd, 820 ppm Rb, 420 ppm Sn, 260 ppm Ta, 6,000 ppm Zn, and Li concentrations exceeding detection limits. In samples 12-54 through 12-56 the dike and wall rock also contains 0.1 ppm Au over a width of 3.2 ft.

Resources

Table 23 summarizes calculations of indicated resources for the Dotson dike system. Calculation of indicated resources is restricted to seven separate sections of the dike system that were shown by mapping to be continuous between sample locations. The calculations, summarized in table 23, assume mineralization continues for one-half the strike length at depth at grade and width equivalent to the average of all samples collected along that particular dike section. Average width and grades were calculated to a minimum mining width of 3.0 ft and assume wall rock grades as previously calculated. All tonnage calculations were based on a tonnage factor of 9.8 ft^3/st (table 5).

Based on the calculations and grades presented in table 23, a total of 2,039,000 st of the Dotson dike system contains a total indicated resource of:

2,353,000 lb Cb	2,541,000 lb Th
326,000 lb U	4,567,000 lb REE
3,666,000 lb Y	

The majority of this indicated resource is contained in dikes between the 400 ft and 1,100 ft contours.

An inferred resource of 8,490,000 st of in Dotson dike system can also be estimated by summing all of the mapped dike lengths and assuming that at least one dike is continuous over the entire 7,000-ft strike length of the dike system and extends offshore to the southeast an additional 25 pct of the strike length. At a grade and width equal to the weighted average of all dike samples collected along the system adjusted to a 3-ft mining width, and at a mineralized depth of 2,500 ft, and deleting the indicated tonnage, the Dotson dike system is estimated to contain an inferred resource of:

12,260,000 lb Cb	18,457,000 lb Y
7,726,000 lb Th	33,280,000 lb Zr
1,647,000 lb U	30,428,000 lb REE

TABLE 23. - Indicated resources at the Dotson prospect.

Dike Section	From Sample	To Sample	No. Sample Sites	Strike Length	Avg Width	Weighted Avg. Grade					Tons $(X10^3)$	Indicated Resources $(X10^3)$				
						Cb	Th	U	REE	Y		Cb	Th	U	REE	Y
A	12-1	12-7	6	800	3.8	437	222	70	790	400	124	110	55	17	200	100
B	12-15	12-26	4	1100	3.6	1215	82	82	780	390	222	540	NC	36	346	173
C	12-8	12-41	16	2650	4.3	430	770	70	747	835	1540	1320	2400	215	2300	2570
D	12-50	12-60	3	350	3.0	743	307	100	2352	1576	19	28	12	4	88	59
E	12-57	12-62	2	250	3.0	670	177	79	1690	1200	10	13	4	2	34	24
F	12-63	12-75	6	800	3.8	1385	281	208	6480	2700	124	343	70	52	1600	700
Total or average			37	5950	3.6	577	623	80	1120	889	2039	2354	2541	326	4568	3626

NC Not calculated

These inferred resources do not include lower grade material contained in the wider dike swarm zones.

CHERI PROSPECT

General Description

The Cheri Prospect consists of a series of hand-excavated trenches, rubble exposures, and radiometric anomalies. Mineralization was first discovered by local prospectors in 1956 and later was mentioned by MacKevett (3), however, the uranium content was relatively low and no detailed examination was ever performed. MacKevett (3) reported that the prospect encompassed a 100 by 300 ft area located on a hill side about 600 ft south of the head of the West Arm of Kendrick Bay (fig. 2). Bureau investigations in 1986 identified NW and SE extensions of the prospect that comprise a N45°W-trending dike system with a mapped strike length of approximately 3,400 ft (fig. 27). In addition, mineralized dike float was located at the high tide level on Kendrick Bay on strike 2,000 ft to the northwest at sample site 13-1 suggesting the Cheri dike system also continues to this point. The prospect is very similar to other dike prospects near Bokan Mountain and consists of steeply dipping, subparallel, radioactive dikes cutting albitized quartz diorite country rock. Dikes occur individually, or in multiple sets. At all locations along the dike system there is at least one dike present ranging in thickness from 0.8 to 1.3 ft. Multiple dike sets occur across widths up to 100 ft, but are locally much more closely spaced.

The area is heavily forested, punctuated by open areas of muskeg, and bedrock is covered by a nearly unbroken vegetative mat. A veneer of glacial till, overlies bedrock at lower elevations and masks the northwest extension of the dike between samples 13-1 and 13-2. Logistical and time limitations of the study prevented further evaluation of the Cheri prospect to the southwest, however, it is likely that the dike system extends beyond the limits of figure 27. The prospect area between sample sites 13-5 and 13-16 (fig. 27) is overlain by federal mining claims active in 1986.

The Cheri prospect, similar to other Bokan Mountain area prospects, occurs within the albitized aureole of the Bokan Mountian intrusive complex. Dikes of the Cheri prospect exhibit little compositional variation and have sharp contacts with the wall rock. Texturally they consist of a fine-grain silicious mass resembling quartzite and range in color from buff-brown to dark gray. Radiometric readings over the dikes commonly range from 1,500 to 4,500 cps compared to a background of about 80 cps over the quartz diorite. At several sites pyroxene-rich masses occur within the dikes and chlorite, magnetite, pyrite, and epidote occur along the selvage. Small pegmatite pods with massive quartz form the core of the dike at sample site 13-4 and dike rubble from the isolated site to the northwest contains a 0.2-ft-thick massive quartz core. At sample site 13-10, the dike was cut by a younger unmineralized pegmatite dike. Minor pyrite, rare fluorite, and secondary uranium was also observed in the dikes. Allanite is the principal radioactive mineral although the other Cb- and REE-bearing radioactive minerals identified in the Dotson prospect are likely present.

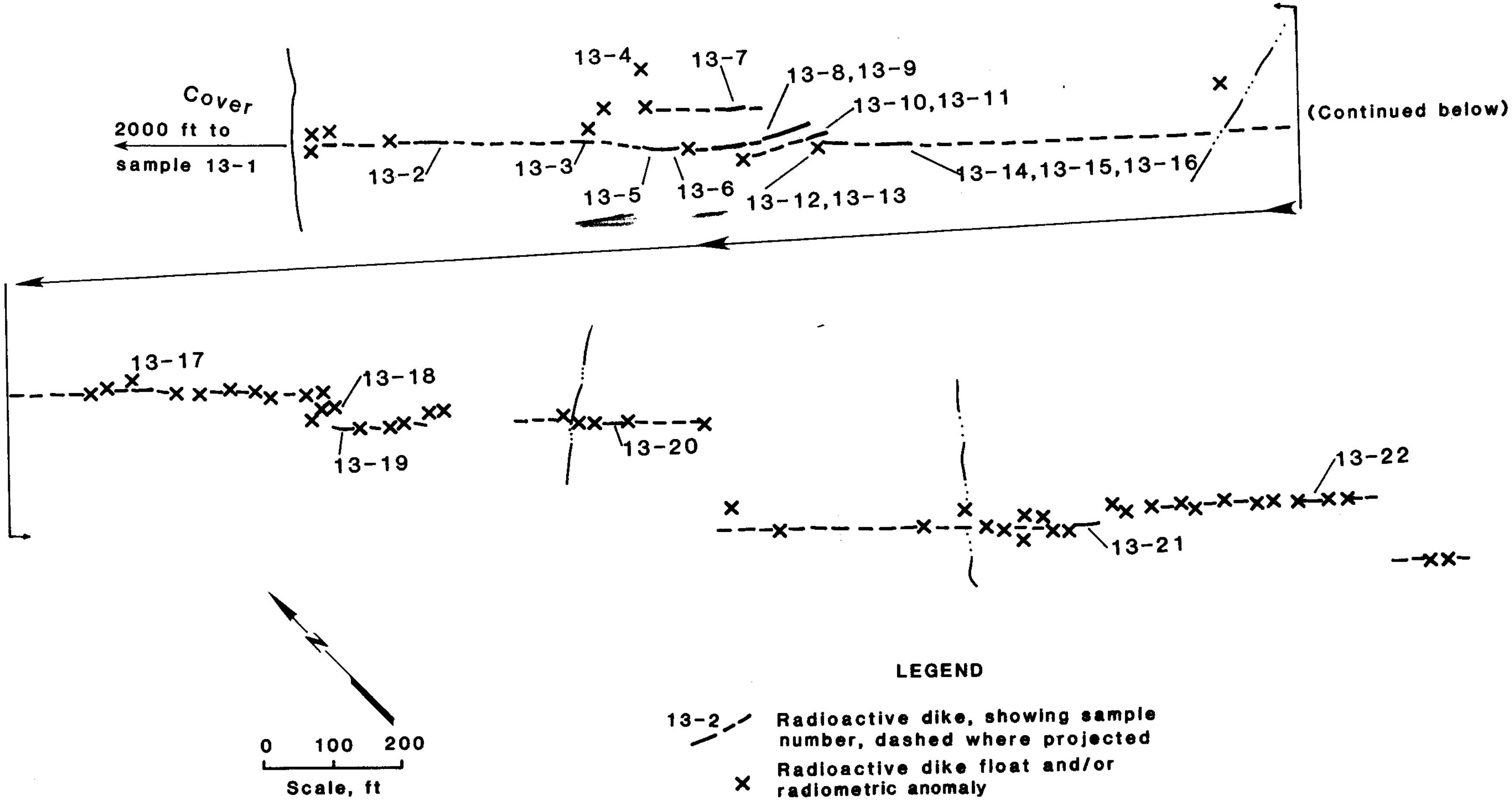


Figure 27 - Geologic and sample location map of the Cheri prospect.

Sampling

Twenty-two samples were collected from mineralized dikes and wall rock at the Cheri prospect (fig. 27 and table 24). Discounting those samples (13-3, 13-4, 13-7, 13-10, and 13-20) collected from thin dikes that are likely subsidiary to the larger, more continuous dike at the prospect, the arithmetic means of sample values recalculated to a minimum 3-ft-wide mining width are:

101 ppm Be	860 ppm Cb
277 ppm Th	123 ppm U
1,419 ppm Y	2,990 ppm REE
0.30 pct Zr	

Concentrations of all of these elements are generally higher in dike samples collected from the southeastern portion of the prospect. A head assay from a bulk sample collected along the northwest portion of the dike is listed in appendix C.

Tantalum is also enriched at the Cheri prospect. The average value of 10 samples containing only dike material was 85 ppm Ta. All samples contained trace levels of Ge (10 to 60 ppm).

Resources

Indicated resources can be estimated for 2 portions of the Cheri prospect: 1) between sample sites 13-2 and 13-16, not including sample 13-3,which is not representative of the dike in this area, and samples 13-4, 13-7, and 13-10, which were collected from float or outcrops of minor subsidiary dikes, and 2) between sample sites 13-17 and 13-22, but not including sample 13-20, which is also not representative of the larger dike in this area. At a mining width of 3 ft, a tonnage factor of 9.8 ft^3/ton, a strike length of 690 ft, and depth of 345 ft, the dike between sample sites 13-2 and 13-16 contains an indicated

91,000 lb Cb	13,000 lb Be
32,000 lb Th	15,000 lb U
109,000 lb Y	349,000 lb REE
350,000 lb Zr	

within 73,000 st of rock grading 622 ppm Cb, 90 ppm Be, 218 ppm Th, 104 ppm U, 748 ppm Y, 2,388 ppm REE, and 0.24 pct Zr. At a mining width of 3.0 ft, a strike length of 1,730 ft, and a depth of 865 ft, the dike between sample sites 13-17 and 13-22, contains an indicated

1,122,000 lb Cb	101,000 lb Be
338,000 lb Th	153,000 lb U
1,602,000 lb Y	3,593,000 lb REE
4,397,000 lb Zr	

in 458,000 st of rock grading 1,225 ppm Cb, 110 ppm Be, 369 ppm Th, 167 ppm U, 1,749 ppm Y, 3,922 ppm REE, and 0.48 pct Zr.

TABLE 24. - Analyses[1] of samples collected at the Cheri prospect.

Sample	Type	Width	Analyses, ppm except as noted					Rare-Earth-Elements														3/
		(ft)	Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE
13-1[2]..	C	1.5	1000	340	129	3300	0.41	910	2040	-	890	20	L	-	-	-	-	-	-	170	20	4050
13-2[2]..	C	2.3	990	290	119	2400	0.42	680	1450	-	510	150	20	-	-	-	-	-	-	130	20	2960
13-3[2]..	Ch	0.4	2300	920	322	9000	1.20	1500	2190	-	1750	550	70	-	-	-	-	-	-	410	50	6520
13-4...	Ch	0.5	1000	1000	267	8000	1.50	2120	4430	-	2000	520	70	-	-	-	-	-	-	390	50	9580
13-5...	Ch	0.8	1280	1275	372	20	1.40	900	L	L	1000	L	L	200	L	L	L	400	40	200	L	2740
13-6...	Ch	0.8	1690	830	372	400	1.10	900	2000	L	1000	L	L	300	L	800	L	400	40	500	L	5940
13-7...	C	1.2	180	60	32	400	0.03	40	2000	L	L	L	L	L	L	800	L	L	L	L	L	2840
13-8...	C	0.5	1100	1585	442	4000	2.00	2000	2000	L	4000	3000	L	500	L	2000	400	800	200	500	L	15400
13-9...	C	1.7	100	L	12	100	L	40	L	L	L	L	L	L	L	L	L	L	L	L	L	40
13-10..	C	0.4	L	L	4	20	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
13-11..	Ch	0.5	2700	1315	392	2000	0.87	900	2000	L	2000	1000	L	300	L	800	400	400	L	200	L	8000
13-12..	C	0.6	2500	1060	377	9000	0.94	2000	5000	L	10000	3000	L	1000	L	2000	500	1000	200	1000	L	25700
13-13..	C	0.8	L	L	7	40	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
13-14..	C	0.7	4300	L	650	900	0.06	4000	5000	L	4000	L	L	500	L	L	L	L	L	L	L	13500
13-15..	C	1.3	L	L	6	20	L	40	L	L	L	L	L	L	L	L	L	L	L	L	L	40

Descriptions

13-1...	6 dikes, less than .1- to .3-ft-wide in float boulder.
13-2...	.8-ft-wide dike and pyrrhotized wallrock.
13-3...	Four .4-ft-wide cobbles of dike float.
13-4...	Light tan radioactive dike.
13-5...	Fine-grained dike.
13-6...	Tan fine-grained dike and breccia with quartz stockwork.
13-7...	Tan fine-grained dike and breccia with quartz stockwork.
13-8...	Sheared dike.
13-9...	Chlorite-altered quartz diorite wallrock on both sides of sample 13-8 dike.
13-10..	Pegmatite vein in quartz diorite near dike sample 13-11.
13-11..	Siliceous green dike with rare fluorite.
13-12..	Siliceous green dike with rare fluorite.
13-13..	Chloritic and pyritic quartz diorite wallrock to sample 13-2 dike.
13-14..	Fine-grained gray siliceous dike with pegmatite pods.
13-15..	Quartz diorite hanging wall to sample 13-14 dike.

TABLE 24. - Analyses[1] of samples collected at the Cheri prospect. - continued

Sample	Type	Width (ft)	Analyses, ppm except as noted: Cb	Th	U	Y	Zr pct	Rare-Earth-Elements: La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE[3]
13-16..	C	2.5	780	70	83	300	0.05	40	L	L	L	L	L	L	L	L	L	L	L	20	L	60
13-17[2].	C	3.0	1200	300	141	1800	0.40	710	1600	-	62	160	20	-	-	-	-	-	-	100	10	2662
13-18[2].	C	1.5	2200	770	287	6500	1.20	1550	3270	-	1470	440	50	-	-	-	-	-	-	310	40	6890
13-19[2].	C	3.0	760	470	150	3100	0.52	1220	2980	-	1370	320	40	-	-	-	-	-	-	190	20	6140
13-20[2].	C	0.2	5000	1300	560	10000	1.60	4110	6550	-	2180	8400	100	-	-	-	-	-	-	590	80	22010
13-21[2].	C	2.8	2300	450	218	2500	0.55	1220	2510	-	1020	230	20	-	-	-	-	-	-	170	20	5190
13-22[2].	C	2.5	1300	380	264	1900	0.52	830	1850	-	730	10	20	-	-	-	-	-	-	140	20	3600

Ch Chip sample. C Channel sample. G Grab sample. H High grade sample. - Not analyzed. D Detected. L Less than detection limit.

[1]See table 4 for description of analytical methods and appendix for additional analyses.

[2]Analyzed at a commercial laboratory.

[3]Estimates of "Total REE" include detection limit "D" values for elements detected near limits of quantification. All 1986-1987 REE values are minimum-only due to self-shielding effect during neutron-activation analysis of samples with REE concentrates; 1986-1987 analyses also do not include values for Pr, Gd, Tb, Dy, Ho, Er, and Tm.

Sample	Descriptions
13-16..	Quartz diorite footwall to sample 13-14 dike, includes 3 dikes each less than .1-ft-wide.
13-17..	1.0-ft-wide dike and 2.0 ft of wall rock.
13-18..	Dike with fluorite veinlets.
13-19..	Sample across 1.1-ft-wide and adjacent 1.9 ft of quartz diorite wall rock.
13-20..	Dike.
13-21..	1.3-ft-wide dike and 1.5 ft of wall rock.
13-22..	.7-ft-wide dike in quartz diorite wall rock.

Additional inferred resources can be estimated by assuming; 1) the dike is continuous for 3,600 ft as traced in figure 27, 2) the dike extends along strike 2,000 ft northwestward to sample site 13-1, and 3) the dike extends for an additional 25 pct (900 ft) of its mapped strike length to the southeast. At a width of 3.0 ft, a grade as calculated in the sampling section, an overall inferred strike length of 6,500 ft, a depth of 2,500 ft, and at a tonnage factor of 9.8 ft^3/st, there is an inferred resource of:

7,643,000 lb Cb	897,000 lb Be
2,461,000 lb Th	1,093,000 lb U
12,609,000 lb Y	26,569,000 lb REE
26,658,000 lb Zr	

within 4,443,000 st of rock.

UPPER CHERI PROSPECT

General Description

The Upper Cheri prospect and the Upper Cheri Extension are sub-parallel to and approximately 2,000 ft southwest of the Cheri prospect. Although a notation of a prospect location in the general area occurs on the geologic map by MacKevett (3), there is no record or description given in the existing literature, nor is there any evidence of prospecting at the site. Mineralization at the Upper Cheri prospect occurs as a set of subparallel radioactive dikes that are remarkably similar to that of the Cheri dikes (fig. 28). Mineralogy, structure, setting, radioactivity, and intrusive characteristics are the same. Individual dike widths vary from 0.2 to 1.3 ft in width and were traced by a radiometric survey and test pits which indicate that the dike system has a width of 200 ft and a minimum strike length of 1,200 ft. Due to the muskeg cover the individual dikes could be only traced intermittently and the system as a whole is open on the southeast end where it is covered by hillside scree, and on the northwest end where it passes under a low-lying creek valley and glacial till.

Outcrop and rubble of radioactive dikes occur on the northern upper slope of a prominent 700-ft-hill about 4000 ft along strike to the northwest. This hillside location is inferred to be an extension of the Upper Cheri prospect.

Sampling

Eight samples were collected across several dikes and wall rock at the Upper Cheri prospect and six more from the Upper Cheri Extension. Individual samples of dike material give values of columbium up to 2,700 ppm and 5,800 ppm Y (table 25). Samples 14-1, 3, 4, 5, 6, and 8 are representative of the principal dikes of the Upper Cheri prospect and give an average grade of 690 ppm Cb, 217 ppm Th, 118 ppm U, 1,251 ppm Y, 0.34 pct Zr, and 3,494 ppm REE, when recomputed over a minimum mining width of 3 ft.

Minor values of beryllium, gold, and tantalum are consistently present in samples from the Upper Cheri prospect.

Resources

It is apparent that the Upper Cheri prospect comprises several mineralized dikes, however, due to cover, it was not possible to map individual dikes for more than a few hundred feet. It, therefore, is inferred that at least one

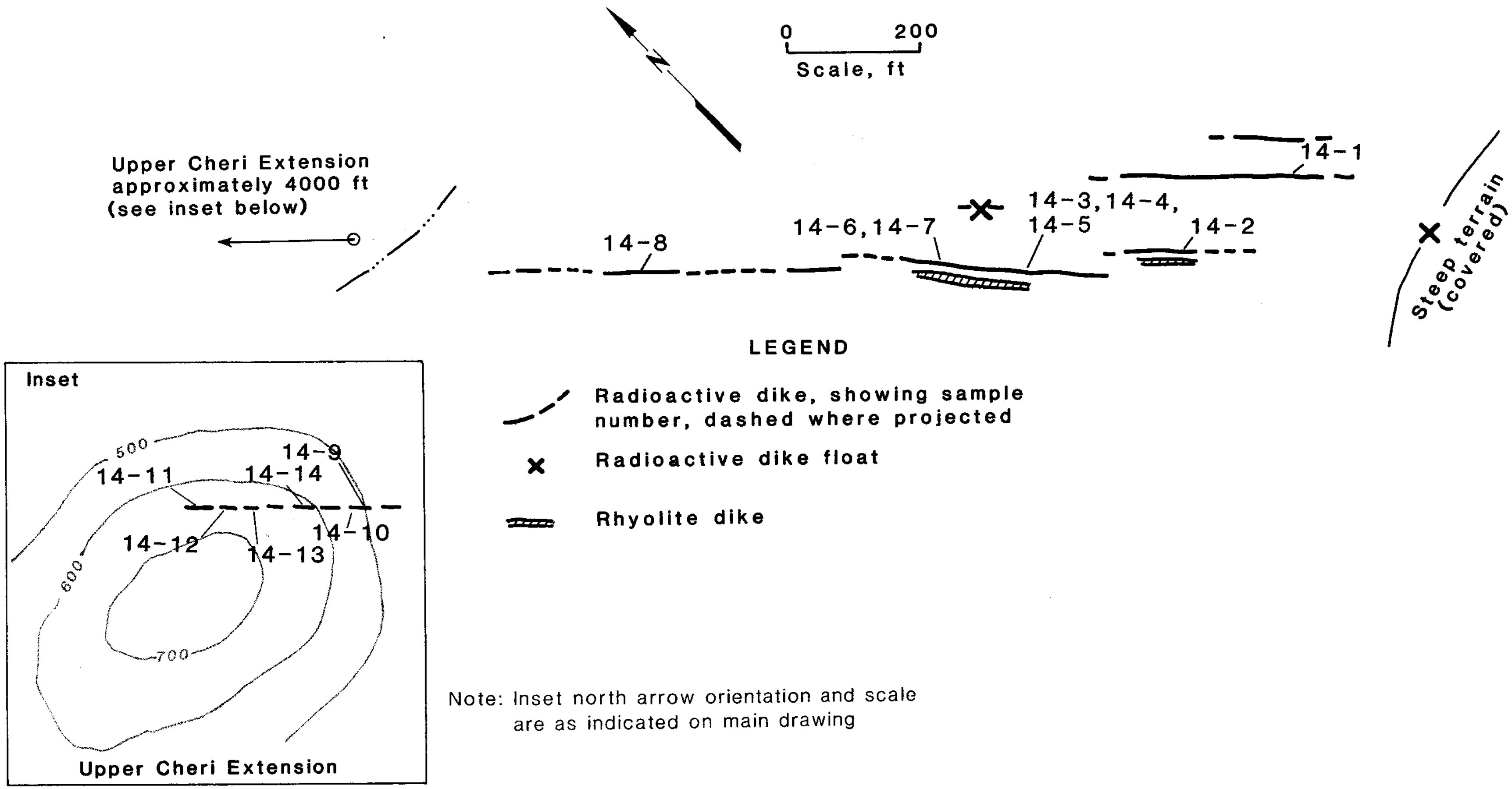


Figure 28 - Geologic and sample location map of the upper Cheri prospect.

dike extends the full mapped length of the prospect plus 25 pct of this distance on either end and has an average grade as determined from the sample data for a minimum mining width of 3 ft. Depth is assumed to be one-half of the inferred strike length. An inferred resource occurs in 481,000 st and contains:

664,000 lb Cb	209,000 lb Th
114,000 lb U	1,203,000 lb Y
3,271,000 lb Zr	3,361,000 lb REE

Several dikes are also present at the Upper Cheri Extension and may be continuous under the intervening 4,000 ft of surficial sediments. Sample data and bedrock observations are, however, too sparse to justify an inferred resource estimate.

SHORE PROSPECT

General Description

The Shore prospect is exposed between the high and low tide lines along the south shore of the West Arm of Kendrick Bay, just north of the Geoduck prospect. The prospect consists of radioactive dike rubble and a few outcrops of dikes that strike obliquely along approximately 1,000 ft of shoreline with an exposed strike length of 700 ft (fig. 29). Dikes occur in a 100-ft-wide zone which cuts intrusion breccia marking the contact between quartz monzonite and quartz diorite.

The dikes strike N50°W, and have vertical to steep dips. Although generally ranging between 0.2 and 0.5-ft-wide, as many as seven thinner dikes may occur over widths up to 1.1-ft-wide. Dense vegetation, soil, till, and low relief prevent tracing the dikes inland and most are continuously exposed for less than 50 ft along strike.

The dikes are texturally and mineralogically very similar to the dikes at the Dotson and nearby Geoduck and Cheri prospects. They consist of buff- to purple-brown- or gray-colored banded quartz and albite with moderately coarse rounded quartz grains or pegmatitic dikes with coarse milky to clear quartz cores with albite selvages. Disseminated and veinlet purple fluorite, pyrite, and black- and amber-colored minerals (likely allanite and REE minerals) are also locally present. Total-count gamma-ray radioactivity ranges from 300 to 3,500 cps, corresponding to approximately 5 to 50 times background; the highest radioactivity is associated with the widest dikes.

Locally, the quartz monzonite intrusion breccia at the Shore prospect is also cut by up to 30-ft-wide zones or dikes of siliceous and pyritic quartz monzonite. These dikes show above-background radioactivity, up to 350 cps, locally are slightly magnetic, and parallel the thinner mineralized dikes.

Sampling

Samples of dikes from the Shore prospect contain anomalously high concentrations of columbium, uranium, thorium, REE, yttrium, zirconium, zinc, titanium, and beryllium (table 26 and appendix B). Some samples also contain elevated concentrations of tin, tantalum, lead, and strontium. Three channel samples of multiple thin dikes and wall rock, each 1.1-ft-long, average 760 ppm Cb.

TABLE 25. - Analyses[1] of samples collected at the Upper Cheri and Upper Cheri Extension prospects.

Sample [2/]	Type	Width (ft)	Analyses, ppm except as noted																			
			Cb	Th	U	Y	Zr pct	Rare-Earth-Elements														Total REE [3/]
								La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	
14-1...	C	3.0	650	240	120	1400	0.31	608	1330	-	683	149	18	-	-	-	-	-	-	91	11	2890
14-2...	C	1.5	490	200	114	1300	0.24	593	1210	-	612	142	17	-	-	-	-	-	-	81	9	2664
14-3...	C	1.0	490	160	96	1100	0.88	481	986	-	479	107	13	-	-	-	-	-	-	82	11	2159
14-4...	C	0.67	570	22	91	720	0.20	744	1740	-	698	119	13	-	-	-	-	-	-	53	6	3373
14-5...	C	1.0	1100	74	191	2400	0.64	2420	5510	-	1930	378	37	-	-	-	-	-	-	159	17	10451
14-6...	C	3.5	190	150	54	730	0.18	348	793	-	362	84	11	-	-	-	-	-	-	53	7	1658
14-7...	C	0.42	670	220	87	710	0.12	436	933	-	397	82	10	-	-	-	-	-	-	41	5	1904
14-8...	C	2.0	1900	590	274	2400	0.45	1690	3400	-	1330	293	32	-	-	-	-	-	-	155	17	6917
14-9...	Ch	0.8	590	59	113	620	0.09	475	1230	-	670	111	12	-	-	-	-	-	-	38	5	2541
14-10..	G	0.8	370	72	41	670	0.10	447	1090	-	460	93	11	-	-	-	-	-	-	40	5	2146
14-11..	Ch	0.42	230	61	28	660	0.12	197	410	-	172	46	6	-	-	-	-	-	-	39	6	875
14-12..	Ch	1.0	350	130	55	1200	0.17	297	615	-	248	70	9	-	-	-	-	-	-	64	8	1311
14-13..	Ch	0.31	830	480	112	5000	0.57	575	1260	-	486	135	18	-	-	-	-	-	-	208	25	2707
14-14..	C	0.50	2700	510	304	5800	0.94	1170	2520	-	1090	327	39	-	-	-	-	-	-	297	37	5480

Ch Chip sample. C Channel sample. G Grab sample. - Not analyzed. D Detected. L Less than detection limit.
M Major concentration detected.
[1]See table 4 for description of analytical methods and appendix for additional analyses.
[2]All samples in this table were analyzed at a commercial laboratory.
[3]Estimates of "Total REE" include detection limit "D" values for elements detected near limits of quantification. All 1986-1987 REE values are minimum-only due to self-shielding effect during neutron-activation analysis of samples with REE concentrates; 1986-1987 analyses also do not include values for Pr, Gd, Tb, Dy, Hob, Er, and Tm.

Sample	Descriptions
14-1...	1.3-ft-wide siliceous gray-green dike and 1.7 ft of quartz diorite wall rock; 2,500 cps.
14-2...	.25-ft-wide dike and 1.3 ft of pyritic and chloritic diorite wall rock; up to 1,100 cps.
14-3...	Sample includes .2-ft-wide dike and .8 ft of wall rock.
14-4...	Pyritic quartz monzonite dike with chlorite veining adjacent to sample 14-3.
14-5...	.6-ft-wide dike and .4 ft of wall rock, located 1.5 ft north of 14-3.
14-6...	Sample includes a .1-ft-wide dike, a .3-ft-wide dike, a narrow aplite dike, and approximately 2.9 ft of wall rock.
14-7...	.42-ft-wide dike 10 ft southeast of sample 14-6.
14-8...	1.2-ft-wide dike and .8 ft of diorite wall rock; up to 1,750 cps.
14-9...	.75-ft-wide fine-grained siliceous brown dike; up to 2,000 cps.
14-10..	.75-ft-wide light brown medium- to fine-grained dike; up to 2,500 cps.
14-11..	.25-in sized dikes distributed across interval.
14-12..	Two medium-grained dikes, .25-in-wide and 1-in-wide, across interval in quartz monzonite.
14-13..	.2-ft-wide dike and 1 in of quartz monzonite wall rock on either side.
14-14..	Float boulder of massive medium-grained dike 0.5 ft in diameter.

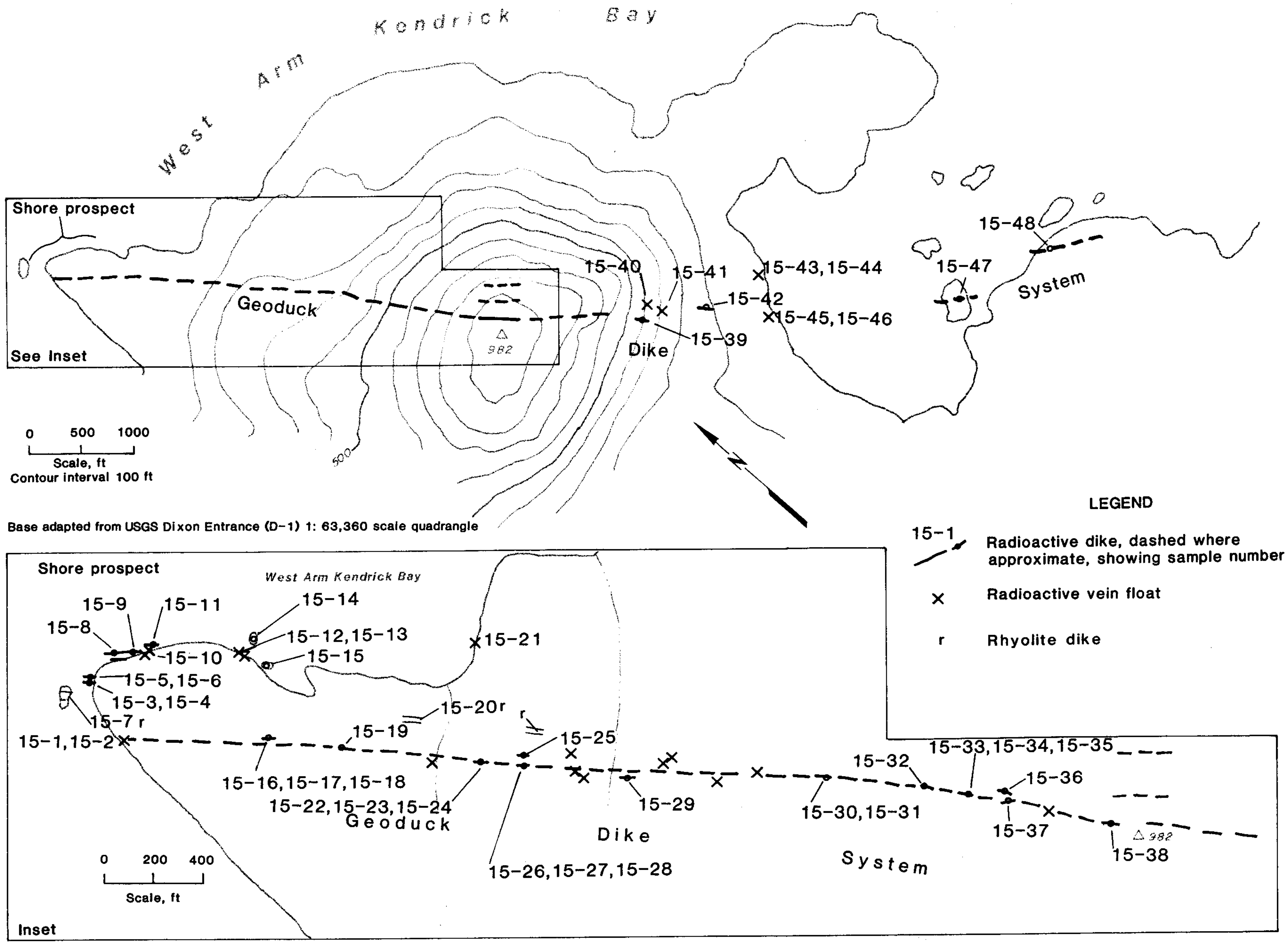


Figure 29 - Geoduck and Shore prospect area.

TABLE 26. - Analyses[1] of samples collected at the Geoduck and Shore prospects.

Sample	Type	Width (ft)	Analyses, ppm except as noted: Cb	Th	U	Y	Zr pct	Rare-Earth-Elements: La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE 3/
15-1...	Ch	0.5	2100	1200	433	4000	2.0	900	1000	D	3000	1000	D	300	L	800	200	800	90	500	L	9290
15-2...	Ch	0.5	1910	1185	425	9000	1.0	2000	2000	D	3000	3000	D	L	L	2000	L	400	L	500	L	13600
15-3...	C	1.1	720	60	148	400	0.1	900	1000	D	3000	D	L	200	L	D	D	L	L	20	L	6520
15-4...	H	0.1	4300	495	628	2000	1.0	4000	5000	D	10000	3000	D	500	L	1000	200	400	90	200	L	25090
15-5...	C	0.4	1760	I	1290	900	0.08	9000	L	D	5000	L	200	L	L	800	L	L	L	20	L	15620
15-6...	C	1.1	710	L	67	100	L	400	1000	D	L	L	D	L	L	D	L	L	L	20	L	2170
15-7...	Ch	30.0	80	L	17	70	0.01	L	D	D	L	L	L	L	L	L	L	L	L	D	L	1110
15-8...	C	1.1	850	L	87	100	0.02	300	D	L	L	L	L	L	L	D	L	L	L	20	L	870
15-9...	H	0.1	2700	510	301	2000	0.9	2000	3000	D	4000	3000	D	500	L	800	D	400	L	100	L	14550
15-10..	G		2260	130	395	300	0.02	2000	1000	D	3000	L	L	L	L	D	L	L	L	20	L	6670
15-11..	Ch	0.2	1900	210	200	800	0.3	900	D	D	1000	L	D	L	L	D	L	L	L	20	L	3170
15-12..	G		2600	620	470	2000	1.0	2000	1000	D	3000	L	D	300	L	800	D	500	40	L	L	8390
15-13..	G		740	185	82	40	0.03	L	D	D	L	L	L	L	L	L	L	L	L	L	L	1100
15-14..	Ch	2.0	100	40	18	100	0.01	L	L	D	L	L	L	L	D	L	L	L	L	L	L	610
15-15..	G		50	L	2	40	L	L	D	D	L	L	L	L	L	D	L	L	L	L	L	1150

Descriptions

Sample	Description
15-1...	Buff to gray, banded quartz-albite dike rock in float; cut by veinlets of quartz-fluorite-pyrite.
15-2...	Buff to gray, banded quartz-albite dike rock in float; cut by veinlets of quartz-fluorite-pyrite.
15-3...	Zone containing five dikes; dikes comprise approximately 30 pct of sample.
15-4...	Dark gray dike high-graded from sample 15-3. Abundant quartz eyes in a dense, albitic(?) matrix cut by numerous hairline fractures. Disseminated gray metallic mineral and pyrite common in more siliceous portion of dike.
15-5...	Purplish brown dike with veinlets and pods of black irridescent material and veinlets of cream-colored albite(?).
15-6...	At least seven dikes, each <1/4 in. across zone. Dikes have quartz cores with finer, buff-colored, albitic (?) margins.
15-7...	Buff-colored silicic quartz monzonite with disseminated cubes of pyrite, cut by veinlets of black minerals.
15-8...	Three 0.5- to 1.5-in-wide mostly quartz dikes across 14-in-wide zone.
15-9...	High-grade of dike on strike of 15-8. Rounded quartz eyes in a green to buff sheared(?) siliceous matrix.
15-10..	Purplish brown dike material with mostly coarse quartz.
15-11..	Chert-like purplish-brown dikes with occasional quartz veinlets, but no sulfide minerals.
15-12..	Abundant dike material in float consisting of mostly quartz in a fine, brecciated (?) greenish matrix containing purple fluorite. Unidentified amber-colored mineral associated with the quartz.
15-13..	Dark-brown dike material from float, contains abundant quartz-eyes in a dense, siliceous matrix.
15-14..	Pinkish to purplish-gray siliceous quartz monzonite dike(?).
15-15..	Slightly magnetic fine-grained siliceous quartz monzonite dike.

TABLE 26. - Analyses[1] of samples collected at the Geoduck and Shore prospects. - continued

Sample	Type	Width (ft)	Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE
			Analyses, ppm except as noted																			3/
								Rare-Earth-Elements														
15-16..	Ch	0.6	50	10	19	90	0.02	45	92	-	36	10	3	-	-	-	-	-	-	7	1	194
15-17..	Ch	1.5	I	420	257	I	I	1240	2260	-	985	280	35	-	-	-	-	-	-	217	252	5269
15-18..	Ch	1.2	L	4	2	L	D	17	37	-	15	3	2	-	-	-	-	-	-	2	D	76
15-19..	Ch	1.3	1900	660	253	6700	1.0	1200	2350	-	1000	333	42	-	-	-	-	-	-	330	38	5294
15-20..	Ch		50	28	13	150	0.29	20	60	-	16	6	D	-	-	-	-	-	-	13	2	619
15-21..	Ch	1.2	1500	830	492	9500	1.10	2750	5350	-	2120	680	92	-	-	-	-	-	-	464	60	11516
15-22..	Ch	2.0	30	3	2	30	D	12	34	-	15	4	2	-	-	-	-	-	-	3	D	70
15-23..	Ch	1.5	2800	520	306	5400	0.92	1270	2830	-	1190	355	43	-	-	-	-	-	-	299	35	6022
15-24..	Ch	1.0	30	6	3	40	0.01	20	48	-	20	6	1	-	-	-	-	-	-	5	1	101
15-25..	Ch	1.0	180	75	38	530	0.09	20	358	-	180	41	7	-	-	-	-	-	-	34	4	635
15-26..	Ch	1.6	430	62	27	260	0.07	197	403	-	150	31	4	-	-	-	-	-	-	21	3	809
15-27..	Ch	1.8	2700	670	242	5800	0.98	2170	4020	-	1570	432	58	-	-	-	-	-	-	319	41	8610
15-28..	Ch	1.3	50	9	10	50	0.01	28	58	-	29	7	2	-	-	-	-	-	-	5	1	130
15-29..	Ch	3.0	450	220	107	1900	0.30	714	1410	-	628	154	19	-	-	-	-	-	-	104	13	3210
15-30..	C	1.3	2600	410	181	8200	1.10	1310	2680	-	1150	320	37	-	-	-	-	-	-	181	22	5700

Descriptions

15-16..	Epidote-altered quartz diorite with manganese staining, from adjacent to 15-17.
15-17..	Granular-textured dike, mostly buff colored with some red to blue banding; 3,000 cps.
15-18..	Chlorite- and epidote-altered quartz diorite with disseminated pyrrhotite. Wall rock of 15-17 opposite 15-16.
15-19..	Sample across zone comprised of 1/4-in- to 4-in-wide dikes and altered wall rock; 3,000 cps.
15-20..	Siliceous dike with abundant disseminated amphibole(?) and trace pyrite; embayed quartz phenocrysts; 250 cps.
15-21..	Composite of chips from float boulder; dike width to 1.2 ft, beige color with dark banding and granular texture; 4,000 cps.
15-22..	Wall rock to 15-23; dark green, highly silicic pyrrhotized rock.
15-23..	Banded, finely granular dike.
15-24..	Wall rock to 15-23, opposite 15-22. Similar to 15-22.
15-25..	.2-ft-wide dike and altered diorite and quartz monzonite wall rock.
15-26..	Hanging wall of dike in sample 15-27. Contains a few .25-in-wide dikes in chloritized diorite(?); 1,500 to 1,000 cps.
15-27..	Granular buff-colored dike with footwall cut by dark veinlets and hanging wall comprised of 2 purplish veins separated by wall rock; 3,000 cps.
15-28..	Footwall to 15-27. Chlorite-altered diorite; 1,200 to 700 cps.
15-29..	Sample includes .4-ft-wide dike and 2.6 ft of epidote-chlorite altered diorite.
15-30..	Brown to purple, finely granular dike; 2,500 cps.

TABLE 26. - Analyses[1] of samples collected at the Geoduck and Shore prospects. - continued

Sample	Type	Width (ft)	Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE[3]
			Analyses, ppm except as noted					Rare-Earth-Elements														
15-31[2].	C	0.4	670	24	56	210	0.05	116	173	-	65	20	3	-	-	-	-	-	-	12	2	391
15-32[2].	Ch	0.5	1000	490	225	2900	0.57	1260	2870	-	1170	314	36	-	-	-	-	-	-	167	19	6836
15-33[2].	Ch	1.1	40	7	5	50	D	20	46	-	24	6	2	-	-	-	-	-	-	4	1	103
15-34[2].	Ch	0.5	3800	700	331	5900	1.00	1980	3970	-	1680	469	53	-	-	-	-	-	-	290	34	8476
15-35[2].	Ch	0.8	70	8	6	40	D	23	55	-	29	6	1	-	-	-	-	-	-	4	1	363
15-36[2].	C	0.5	460	110	51	1100	0.31	317	681	-	300	77	9	-	-	-	-	-	-	54	6	1830
15-37[2].	C	1.3	390	110	57	1100	0.04	355	863	-	356	93	11	-	-	-	-	-	-	54	6	1738
15-38[2].	Ch	0.3	2400	450	174	3800	0.62	1600	3220	-	1350	358	39	-	-	-	-	-	-	177	22	6766
15-39[2].	C	0.3	4200	380	446	3800	0.62	3410	6690	-	2670	666	64	-	-	-	-	-	-	92	11	13603
15-40[2].	C	0.2	5300	390	495	3300	0.69	3410	6800	-	2630	660	61	-	-	-	-	-	-	102	11	13674
15-41[2].	Ch	0.2	4300	340	483	3900	0.62	3030	6040	-	2620	570	57	-	-	-	-	-	-	98	11	12426
15-42[2].	C	0.3	5900	360	211	2300	0.58	3040	5500	-	2010	412	41	-	-	-	-	-	-	68	7	11078
15-43[2].	CR	0.8	4200	380	514	3300	0.52	3930	6750	-	3020	658	78	-	-	-	-	-	-	109	12	14557
15-44[2].	C	0.8	4100	950	395	7300	1.10	2890	5270	-	2460	652	87	-	-	-	-	-	-	432	53	11844

Descriptions

Sample	Description
15-31..	0.4 ft of hanging wall and 0.4 ft of footwall to 15-30. Cut by numerous thin dikes similar to the larger dike in 15-30; 2,400 cps.
15-32..	Sample includes a 2-in-wide and .25-in-wide radioactive dike and altered wall rock.
15-33..	Slightly pyrrhotized quartz diorite wall rock to dike sample 15-34.
15-34..	Finely granular buff-colored radioactive dike.
15-35..	Wall rock adjacent to 15-34 and opposite and similar to 15-33.
15-36..	Buff-colored radioactive dike.
15-37..	Sample includes three .25-in-wide to .5-in-wide dikes and three to five thin dikes in wall rock of chloritized diorite.
15-38..	Sample includes two 1-in-wide dikes and altered wall rock.
15-39..	Sample of dike traceable in rubble for 200 ft. Includes approximately 10 pct wall rock; 300-400 cps.
15-40..	Radioactive dike hosted by gneissic(?) diorite. Sample includes 10 pct wall rock; 1,000 cps.
15-41..	Sample is of .2-ft-wide dike material from float boulder.
15-42..	Coarsely granular brown radioactive dike. Sample includes .5-in of altered andesite from both hanging and footwalls.
15-43..	Dike material in float boulders of quartz monzonite. Up to eight dikes <.2-in- to 1-in-wide, over 9-in width. Sample includes 45 pct wall rock.
15-44..	Sample of float boulder of dike; margins not present, so actual dike width is wider than .8 ft.

TABLE 26. - Analyses[1] of samples collected at the Geoduck and Shore prospects. - continued

Sample	Type	Width (ft)	Cb	Th	U	Y	Zr pct	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Total REE[3]
			Analyses, ppm except as noted					Rare-Earth-Elements														
15-45[2].	Ch	0.7	3300	610	324	6600	0.87	1820	3720	-	1570	449	52	-	-	-	-	-	-	308	37	7956
15-46[2].	G		60	35	18	230	0.07	48	105	-	47	15	D	-	-	-	-	-	-	17	2	234
15-47[2].	Ch	1.0	710	75	28	580	0.07	239	446	-	215	47	6	-	-	-	-	-	-	30	4	987
15-48[2].	G		4500	240	260	1900	0.30	2640	4400	-	1990	404	48	-	-	-	-	-	-	64	8	9554

Ch Chip sample. C Channel sample. CR Random chip sample. G Grab sample. H High grade sample. - Not analyzed. D Detected.
L Less than detection limit.
M Major concentration detected.
[1]See table 4 for description of analytical methods and appendix for additional analyses.
[2]Analyzed at a commercial laboratory.
[3]Estimates of "Total REE" include detection limit "D" values for elements detected near limits of quantification. All 1986-1987 REE values are minimum-only due to self-shielding effect during neutron-activation analysis of samples with REE concentrates; 1986-1987 analyses also do not include values for Pr, Gd, Tb, Dy, Ho, Er, and Tm.

	Descriptions
15-45..	Chips of float boulder of dike.
15-46..	Felsic dike with black dikes of fine-grained mineralogy; 300 cps.
15-47..	Eighteen .1- to .2-in-wide dikes across zone.
15-48..	Sample of dike material. Dikes up to .2-ft-wide distributed across 2-ft-wide width.

The dikes are particularly enriched in REE, especially cerium and neodymium and have up to 2.5 pct total REE in samples comprising only dike material. Samples of wider silicic and pyritic quartz monzonite dikes do not have anomalous concentrations of any metals.

Resources

Although columbium and REE grades of many of the dikes are relatively high, their generally narrow widths indicate that only negligible volumes of mineralized material are present in the exposed segments of the Shore prospect.

GEODUCK PROSPECT

General Description

The Geoduck prospect consists of a system of dikes that can be traced approximately 11,000 ft from the hightide line on the West Arm Kendrick Bay southeasterly along a strike of N40°-50°W (fig. 29). On its northwestern end, the Geoduck dike system parallels dikes of the Shore prospect, which lies 400 ft to the north. The Geoduck dikes are exposed over 980 ft vertically and have vertical to steep northerly dips. Because of the northerly dip, the trace of the dike veers southward where the dike crosses higher terrain (fig. 29). For much of the strike length, two or more parallel dikes or multiple sets of dikes were observed. On the northwest end, dike widths average about 1.4 ft. To the southeast, however, dike widths were not found to exceed 0.5 ft, although one piece of float indicated a dike width of 0.8 ft.

Because of the dense forest cover, individual dikes generally can only be examined by hand-dug test pits, however, similarities in strike and linear radiometric anomalies ranging from 300 to 3,000 cps, indicate the dike system is continuous. In particular, a relatively large continuous dike averaging 1.5-ft-wide extends at least from the shore of Kendrick Bay, at sample sites 15-1 and 15-2, 3,000 ft southeasterly to an elevation of about 400 ft at sample sites 15-30 and 15-31.

Geoduck dikes are similar to most dikes mapped elsewhere at Bokan Mountain. They range from light to dark brown or beige to gray, occasionally with a purple or pink cast, and are generally fine- to medium-grained and granular in texture. The dikes are sometimes banded or cut by veinlets of quartz or opaque minerals. For most of its strike length, the Geoduck dike system has chlorite- and epidote-altered pyritic quartz diorite wall rocks. The southeastern extent of the dikes, however, are hosted by quartz monzonite that locally has a gneissic texture.

Sampling

The dikes contain anomalously high concentrations of numerous elements that are laterally zoned. Generally, concentrations of beryllium, columbium, germanium, REE (excluding yttrium), strontium, tantalum, and zinc are higher in dike samples collected from the southeastern portion of the prospect area whereas concentrations of hafnium, lead, thorium, yttrium, zirconium, and possibly gold are higher in samples collected from the northwestern portion (table 26). Recalculated to a minimum mining width of 3 ft, the 3,000 ft of dike strike length between samples 15-1 and 15-31 (including samples 15-1, 15-2, 15-17 to 15-24, 15-26 to 15-28, 15-30 and 15-31) averages 101 ppm Be, 1,070 ppm Cb, 370 ppm Th, 180 ppm U, 3,240 ppm Y, 0.60 pct Zr, and 4,390 ppm REE. Dike samples collected along this strike length also contain up to 0.30 ppm Au, 40 ppm Ge, 730 ppm Hf, 900 ppm Rb, 150 ppm Ta, and 5,500 ppm Zn. At sample site 15-30 and 15-31, the dike and wall rocks contain 0.25 ppm Au over 2.1 ft and a head assay of a bulk sample collected near here contains 0.26 % Cb, 0.67 Y, and 1.83 % La, Ce, Nd combined (appendix C).

On the southeastern end, on the other hand, samples of dikes average 302 ppm Be, 3,984 ppm Cb, 453 ppm Th, 333 ppm U, 4,011 ppm Y, 0.65 pct Zr, and 10,000 ppm REE over about 0.4 ft. These samples also contain up to 40 ppm Au, 50 ppm Ge, 130 ppm Hf, 2,200 ppm Pb, 1,800 ppm Zr, 250 ppm Ta, 450 ppm V, and 4,300 ppm Zn. When considered over minimum mining widths, only a few samples collected from the southeastern portion of the dike system have grades comparable to those on the northwest end. Calculated to a minimum mining width of 3.0 ft, samples 15-43, 15-44, and 15-48 contain the equivalent of or slightly more than 1,000 ppm Cb. Samples 15-43 and 15-44 also contain an equivalent of about 1,180 ppm and 1,347 ppm Y, 0.19 pct and 0.29 pct Zr, and 5,210 and 3,160 ppm REE over 3.0 ft, respectively.

Resources

Indicated resources can be estimated for the single larger dike on the northwest end of the system which has 3,000 ft of traceable strike length. Assuming it continues for one-half its strike length at depth, at an equivalent grade of 101 ppm Be, 1,032 ppm Cb, 273 ppm Th, 130 ppm U, 2,945 ppm Y, 0.47 pct Zr, and 3,188 ppm REE over 3.0 ft, and at a tonnage factor of 9.8, this dike contains indicated resources in 1,378,000 st of:

278,000 lb Be	2,844,000 lb Cb
752,000 lb Th	358,000 lb U
8,116,000 lb Y	12,953,000 lb Zr
8,786,000 lb REE	

Assuming at least one dike: 1) is continuous along the entire 9,500 ft of the discontinuously traced dike system, 2) continues for an additional 25 pct of the total strike length in each direction, 3) extends to a depth of 2,500 ft, and 4) has a grade equivalent to the average of all samples collected from the prospect adjusted to a width of 3.0 ft (100 ppm Be, 780 ppm Cb, 185 ppm Th, 102 ppm U, 1,573 ppm Y, 0.29 pct Zr, and 2,710 ppm REE), an inferred resource in 9,528,000 st contains:

1,906,000 lb Be	14,864,000 lb Cb
3,525,000 lb Th	1,944,000 lb U
29,975,000 lb Y	55,262,000 lb Zr
51,642,000 lb REE	

*** PLACER PROSPECTS - KENDRICK BAY AND MOIRA SOUND

GENERAL DESCRIPTION

The West Arm Kendrick Bay is a 2 mi-long glaciated fiord that heads against Bokan Mountain. Pleistocene glacial advances from higher elevations have transported sediment into and beyond Kendrick Bay while scouring the West Arm during the accompanying periods of much lower sea levels. Presumably much or all of the floor of Kendrick Bay was above sea level at those times. On retreat of glaciers, till was deposited and reworked by the combination of meltwater and the area's high precipitation run-off, and eventually by the rising sea levels. A similar sequence of events occurred on the South Arm Moira Sound, including Perkins Creek, which has remained above sea level.

Today, both Kendrick Bay and Moira Sound are being slowly infilled by fine-grained, organic-rich sediment, particularly in low areas that are protected by seaward bedrock obstructions (fig. 30). Former glaciofluvial sediments that may be of interest for placer deposits, are now covered by more recent sediments. Nevertheless, it was the objective of the current investigation to examine the geomorphic features and to determine if placer metal enrichment could be demonstrated in recent sediments as an indication of possible concentrations in the deeper ancient channel ways.

SAMPLING

Eight placer samples were collected along a line roughly centered along the profile of the upper West Arm Kendrick Bay (fig. 30). Sampling was hampered by water depths beyond range of available equipment and by overlying accumulations of silty muck.

Three placer samples were also collected from the tidal zone on the South Arm Moira Sound. Sample 16-9 is from the left limit channel way of Perkins Creek just below the high tide level, whereas 16-10 is from the alluvial fan further out in the tidal zone. Sample 16-11 is from the alluvial fan tidal area of the small creek which drains the tarn on the west side of Bokan Mountain.

Two samples were collected from Perkins Creek, 1.2 mi above the mouth. Sample 16-13 is from the active channel and 16-12 is from the alluvial terrace at a depth of 4 ft (fig. 14).

Concentrates were prepared by tabling the minus 16 mesh fraction of the samples. Representative splits were analyzed and elemental values are shown in table 27 and appendix B. It is evident that low grade placer enrichment has occurred in all samples except 16-5 to 16-8. These later samples appear to be largely derived from local bedrock sources, rather than fluvial orgins.

RESOURCES

Sampling to date has determined no resources, but does suggest higher grade zones are possible in buried ancient channels.

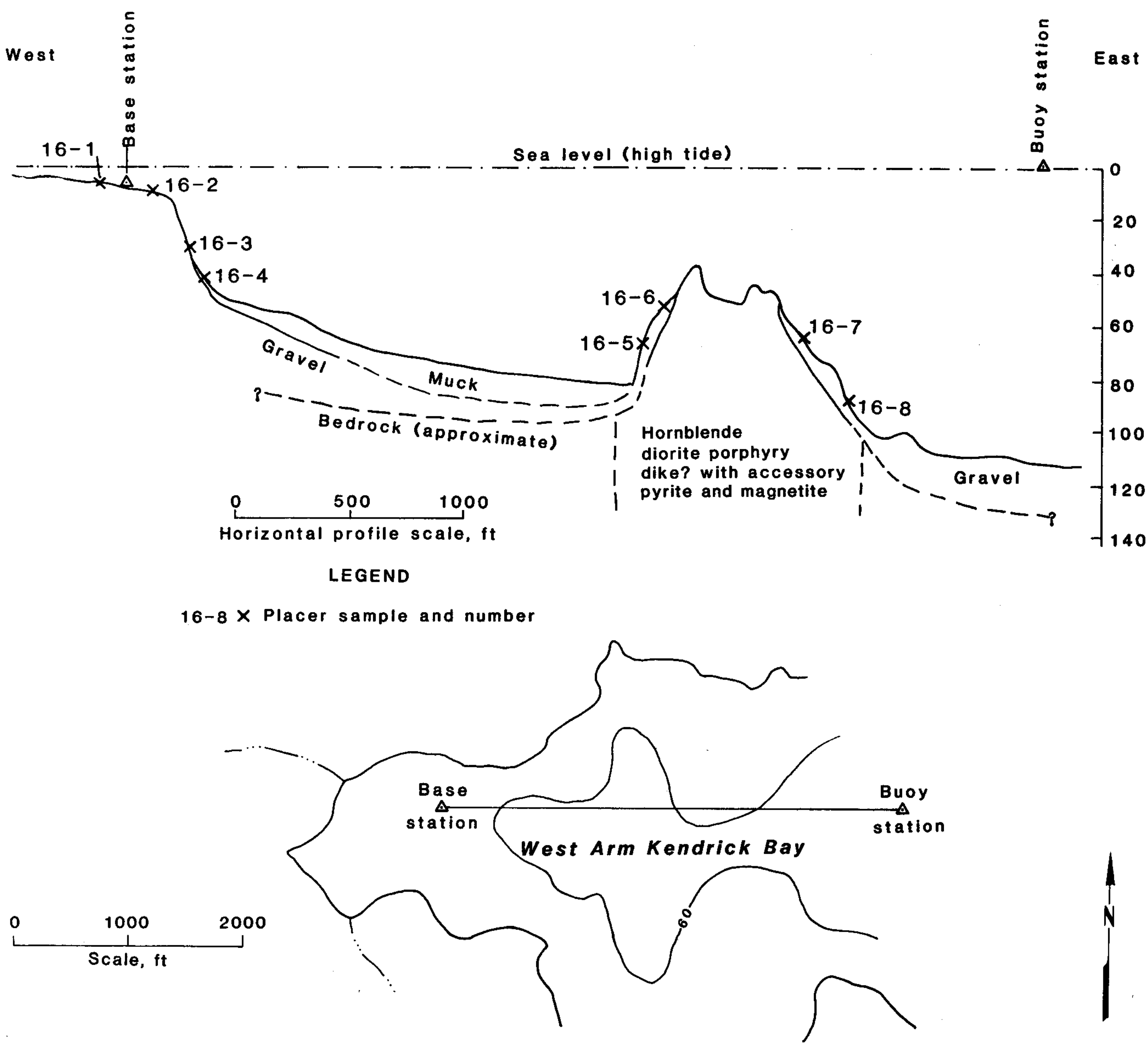


Figure 30 - Profile of Kendrick Bay.

TABLE 27. - Placer samples results from the Bokan Mountain area

Sample No.	Loose Sample Volume (yd^3)	Tabling Concentrate (g)	Lithophile elements 1/		Zirconium	
			ppm	calculated g/yd^3	pct	calculated g/yd^3
16-1......	0.025	210.51	1851	16	1.0	84
16-2......	0.059	232.33	2377	9	1.4	55
16-3......	0.017	316.21	794	15	0.39	72.5
16-4......	0.020	277.88	1012	14	0.49	68.1
16-5......	0.022	415.30	172	3	L	L
16-6......	0.012	198.59	341	6	0.11	18.2
16-7......	0.022	229.33	299	3	0.14	14.6
16-8......	0.020	320.11	202	3	L	L
16-9......	0.025	120.5	1042	5	0.55	26.5
16-10.....	0.025	191.49	1595	12	1.1	84.3
16-11.....	0.025	205.65	1503	12	0.93	76.5
16-12.....	0.005	72.8	1839	27 2/	1.10	148
16-13.....	0.005	19.7	5069	20 2/	1.40	51

1/Total of analysis for Cb, Ce, Eu, Hf, La, Lu, Rb, Sm, Sc, Ta, Tb, Th, Sn, W, U, Tb, and Y. Individual analyses given in appendix.
2/Does not include analyses for Yttrium.

	Descriptions
16-1......	Sample to 1 ft depth in loose sandy gravel with little silt fraction, cobbles to 4 in.
16-2......	Sample to 1 ft depth in loose sandy gravel with little silt fraction, cobbles to 4 in.
16-3......	Sample to 2 ft depth on slope composed of well-rounded sandy gravel in matrix of black clay.
16-4......	Sample to 2 ft depth on slope composed of well-rounded sandy gravel in matrix of black clay.
16-5......	Angular cobbles and gravel on sloping bottom.
16-6......	Angular cobbles and gravel.
16-7......	Angular cobbles and sandy gravel, some silt size fraction.
16-8......	Hard packed shingled cobbly gravel, rock type in predominantly sub-angular diorite, gently sloped bottom, sample to 1 ft depth.
16-9......	Sandy gravel on left limit of channel way.
16-10.....	Sub-angular sandy gravel and granite greiss overlying ferricreted gravel strata.
16-11.....	Sandy gravel unit, 2-ft-thick, that overlies a gray clay hard-bar unit.
16-12.....	Stratified sand from 4-ft-deep pit in terrace adjacent to Perkins Creek.
16-13.....	Poorly sorted sandy gravel from main channel of Perkins Creek.

*** DISCUSSION

The columbium-bearing deposits at Bokan Mountain have no close recognized counterpart elsewhere in the world. Therefore, there is no direct ore deposit model available to aid in assessment of resources in deposits at Bokan Mountain. There are some similarities to deposits of columbium and other minerals associated with the peralkaline ring complexes of Nigeria. The peralkaline granites in both areas contain highly anomalous concentrations of numerous large-cation, highly charged lithophile elements (13). Although the peralkaline complexes of Nigeria are characterized by a wide range of possibly economically significant elements, the most-important elements, including tin, columbium, tantalum, tungsten, molybdenum, zinc, lead, cadmium, silver, copper, bismuth, and lithium occur dominantly in disseminations, greisen, and fissure-filling veins associated with biotite-bearing, rather than riebeckite- or aegirine-bearing granites (18). It should also be noted that although columbite has been recovered from placer deposits in Nigeria, known lode sources are uneconomic.

In contrast, deposits at Bokan Mountain are highly enriched in REE, uranium, thorium, columbium, yttrium, zirconium, and numerous other commodities and consist of shear zones, pegmatites, and mineralized dikes associated with riebeckite- or aegirine-bearing granite. Although a minor volume of biotite aplite has been identified at Bokan Mountain, no biotite granite has been noted and mineralized greisen was found at only one isolated location at the Irene-D prospect. Only relatively low concentrations of tin are present in the Bokan deposits.

Additionally, unlike REE deposits elsewhere in the world that tend to be enriched in only the light (cerium subgroup) elements, and a few that contain only the heavy (yttrium subgroup) elements, many of the REE-bearing deposits at Bokan Mountain are enriched in both light and heavy REE (fig. 31). This unique facet of the Bokan Mountain deposits is undoubtedly the result of their polymineralic nature, in clear contrast to deposits worldwide that tend to be largely monomineralic.

Provinces of alkaline rocks elsewhere in the world comprise clusters or irregular linear trends of igneous rocks of various ages and compositions (19). For example, the complexes of Nigeria and Cameroon, in west-central Africa define a sinuous, several hundred-mi-long belt composed of both extrusive and intrusive alkaline igneous rocks ranging from 550 to 30 million years in age.

Similarly, the Bokan Mountain peralkaline granite complex is but one of several identified alkaline complexes of various ages that form a northwesterly trending, approximately 30-mi-long belt on southern Prince of Wales Island. Southeast of Bokan Mountain other complexes along this belt include syenite, quartz syenite, quartz monzonite, and pyroxenite at Stonerock Bay (dated at 438 million years)(20) and undated carbonatite on McLean Arm. Approximately 20 mi northwest of Bokan Mountain, on the other hand, eudialyte-bearing diorite, nephelene syenite and pegmatities of possible Mesozoic age are exposed near the head of Dora Bay (21).

The geologic significance of this poorly defined alkaline plutonic belt on southern Prince of Wales Island is, as yet, not well understood. Its actual extent is unknown and may continue farther to the north or northwest as suggested by columbium-REE carbonate veins near Salmon Bay.

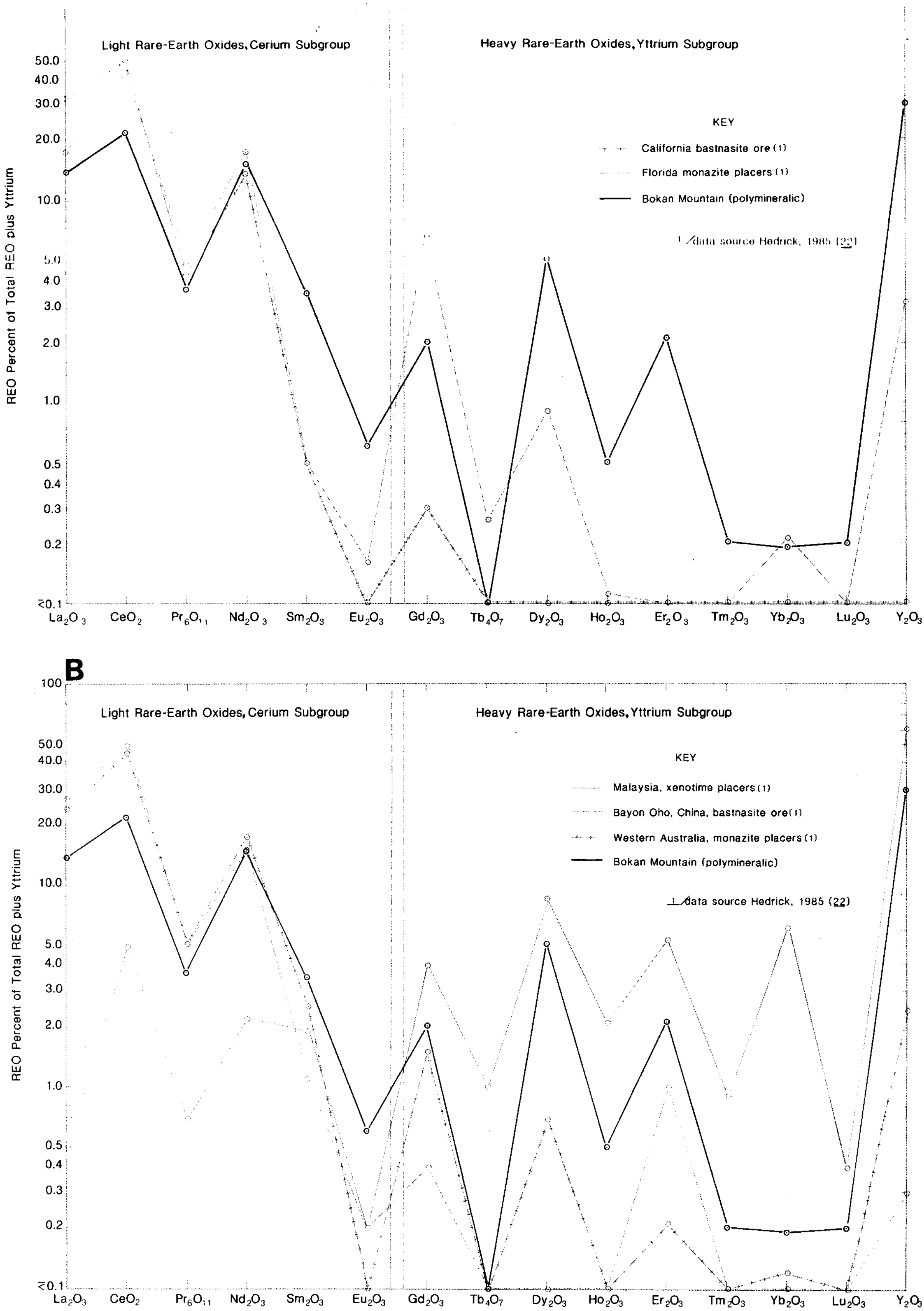


Figure 31 - Percent composition of REO at Bokan Mountain as compared to U.S. and principal world REO deposits.

General similarities in composition between various alkaline rocks on Prince of Wales Island compared to that of the complex at Bokan Mountain suggest that other identified complexes as well as the relatively little-prospected areas between them and along strike to the northwest of Dora Bay contain good potential for mineralization similar to that found at Bokan Mountain.

Near Bokan Mountain, there is an excellent reserve development potential due to the likelihood of additional discoveries. To date the accumulated exploratory work in the vicinity of Bokan Mountain has identified 37.5 MM tons of mineralized material contained in nine deposits. On the basis of geologic inferrence, it is reasonable to expect that as much as two or three times this much tonnage is contained in the known deposits, presuming they were to be traced to their full extent under surficial cover. For instance, nearer the Bokan intrusion both the Dotson and the Geiger dike deposits attain their maximum width and consequently much of the contained tonnage. Similar thickening is presumed to occur on the Geoduck, Cheri, Shore, and Upper Cheri prospects, however, the corresponding portions of these dike systems are masked by surficial cover.

In addition to the known deposits it is likely that yet undiscovered deposits occur in the vicinity of Bokan Mountain. As suggestions for further prospecting the following comments are offered: 1) dike deposits - probably the most likely type of commercial deposit to be found. Very little reconnaissance has been conducted west of the Upper Cheri prospect and it is possible additional dikes underlie the West Arm Kendrick Bay and the alluvial valley at the head of the bay. No evidence of additional dike systems was found along the South Arm Moira Sound, however, the possibility can not yet be ruled out. There appears to be a tendency for dikes to thicken with depth, as well as with proximity to the Bokan Mountain intrusion and this feature should be employed as an exploration guide; 2) pegmatites - the border zone pegmatite was located on about half of the perimeter of the intrusion and is likely more extensive than presently mapped. Limited higher grade lenses and zones may occur within the border zone, but will require detailed mapping and geophysical survey before resources can be defined. The occurrence of mineralized greisen associated with the border zone should be further examined; 3) shear zones and replacement deposits - the Ross-Adams mine has been extensively drilled and contains significant reserves of uranium, thorium, and lesser yttrium. The Sunday Lake prospect shows some similarities to the Ross-Adams deposit and should be further evaluated. The occurrence of beryllium in the Dotson Shear Zone prospect and the mineralized greisen at Irene D prospect are not well understood and should be further investigated; and 4) placers are of very low grade, but buried higher grade alluvial channels are possible. Particular attention should be given to the existing valley of Perkins Creek, the offshore extent of ancient channels of Perkins Creek, and to the alluvial valley at the head of the West Arm Kendrick Bay.

Mineral deposits near Bokan Mountain are long, tabular, dip near vertical and will require underground mining techniques if they are to be developed. Mining width would range from 3- to probably no more than 15 ft. The pipe-like Ross-Adams deposit is the only exception. The known deposits near Bokan Mountain all occur in competent crystalline rock, and although no sample testing was done for mine engineering criteria, it is expected that mining would encounter few significant ground control problems. Dike deposits in particular, generally occur in competent quartz monzonite or diorite which has been albitized and silicified due to alteration associated with the intrusion. Appropriate mine design, however, will be required for underground workings in weak to moderately radioactive material. Recovery of valuable metals from deposits at Bokan Mountain will require treating thorium-rich materials for which there is presently little or no use for the contained thorium. This radioactive material will require disposal or storage. Economically viable beneficiation techniques to recover the numerous co- and by-products in the Bokan deposits have not yet been demonstrated, however research is in progress.

*** SUMMARY OF RESOURCE ESTIMATES

Tables 28-30 summarize resource estimates made at Bokan Mountain and lists the equivalent commercially traded oxide content. Significant mineralization was found to occur in 9 deposits which aggregate a total of 37.8 MM tons. Indicated and inferred resources total:

96,210,000 lb Cb_2O_5	21 pct indicated, 79 pct inferred
27,890,000 lb ThO_2	30 pct indicated, 70 pct inferred
11,770,000 lb U_3O_8	28 pct indicated, 72 pct inferred
637,550,000 lb ZrO_2	27 pct indicated, 73 pct inferred
240,990,000 lb REO	18 pct indicated, 82 pct inferred
133,080 lb Y_2O_3	21 pct indicated, 79 pct inferred
2,060,000 lb Ta_2O_5	34 pct indicated, 66 pct inferred
8,860,000 lb BeO	12 pct indicated, 88 pct inferred

Approximately 45 pct of the total inferred and indicated columbium-oxide resources has a grade greater than 0.125. About 80 pct of the REO plus the yttrium oxide resources exceed 0.5 pct. Similarly, zirconium-oxide grades range from 0.5 to 2.5 pct. Cut-off grades of 0.025 BeO and 0.0125 Ta_2O_5 were utilized for those metals. The effect of self-shielding during the neutron activation procedure employed to analyze most of the samples resulted in resource estimates that are considered minimal. Actual contained REE, yttrium, and to some extent, the columbium resource, may be substantially greater than those values listed above.

Sample data indicates hafnium to be present at levels equivalent to 2.0 pct or more of the zirconium values. No hafnium resource is calculated because most current end-uses of zirconium do not generally separate the contained hafnium.

Although shear zones and fracture-controlled deposits (at the Ross-Adams mine) contain most of the indicated uranium and thorium resources, dike deposits far outweigh other deposit types in terms of total estimated resources. Combined, the Geiger and Geoduck dike prospects alone contain 68 pct of the total beryllium resource, 62 pct of the columbium, 77 pct of the zirconium, 60 pct of the REE, 100 pct of the tantalum, and 61 pct of the yttrium total resources. These two prospects also contain 52 pct of the uranium and 25 pct of the thorium total resources, but at grades far less than those at the Ross-Adams mine or Sunday Lake prospect.

TABLE 28. - Summary of Grade and Indicated Tonnage for Bokan Mountain Deposits.

Deposit[1]	Indicated Tonnage, st	Grade, Pct							
		Cb_2O_5	ThO_2	U_3O_8	Y_2O_3	ZrO_2	REO[2]	BeO	Ta_2O_5
Ross Adams...	365,000	-	0.46	0.17	0.40[3]	0.32[3]	0.086[3]	-	-
Geiger.......	2,450,000	0.219	0.009	0.021	0.168	2.43	0.458	-	0.014
I & L........	21,000	0.186	0.114	0.094	-	-	-	-	-
	23,000	0.096	-	-	-	-	-	-	-
	50,000	0.100	-	-	-	-	-	-	-
	6,000	0.300	-	-	-	-	-	-	-
Dotson.......	2,039,000	0.083	0.071	0.009	0.113	-	0.132	-	-
Cheri........	73,000	0.089	0.025	0.012	0.095	0.32	0.281	0.025	0.01
	458,000	0.175	0.042	0.020	0.222	0.65	0.461	0.03	0.01
Geoduck......	1,378,000	0.148	0.031	0.015	0.374	0.64	0.375	0.028	-
TOTAL INDICATED TONNAGE	6,863,000								

\- Not determined, only minor values present.
[1]Only those deposits for which an indicated tonnage were calculated are listed here.
[2]REO does not include yttrium.
[3]These values determined only on basis of Bureau sampling of drill core.

TABLE 29. - Summary of Grade and Inferred Tonnage for Bokan Mountain Deposits.

Deposit[1]	Inferred Tonnage, st	Grade, Pct							
		Cb_2O_5	ThO_2	U_3O_8	Y_2O_3	ZrO_2	REO[2]	BeO	Ta_2O_5
Sunday Lake..	27,000	0.070	3.64	0.59	1.030	0.38	0.329	-	-
ILM..........	586,000	0.176	-	0.017	0.083	3.34	0.353	-	-
Geiger.......	4,693,000	0.219	-	0.021	0.168	2.43	0.458	-	0.014
	2,600,000	0.062	0.009	0.008	0.163	1.0	0.149	-	-
I & L	37,000	0.100	-	-	-	-	-	-	-
	5,000	0.300	-	-	-	-	-	-	-
Dotson.......	8,490,000	0.103	0.052	0.011	0.138	0.26	0.210	-	-
Cheri........	4,443,000	0.123	0.032	0.014	0.180	0.41	0.352	0.025	0.01
Upper Cheri..	481,000	0.099	0.025	0.014	0.159	0.46	0.411	-	-
Geoduck......	9,528,000	0.112	0.021	0.012	0.200	0.39	0.319	0.028	-
TOTAL INFERRED TONNAGE	30,899,000								

- Not determined, only minor values present.

[1]Only those deposits for which an inferred tonnage was calculated are listed here.

[2]REO does not include yttrium.

TABLE 30. - Summary of principle resources in the Bokan Mountain deposits.

Deposit	Indicated Resources, MM lbs. Cb_2O_5	ThO_2	U_3O_8	Y_2O_3	ZrO_2	REO[1]	BeO	Ta_2O_5	Inferred Resources, MM lbs. Cb_2O_5	ThO_2	U_3O_8	Y_2O_3	ZrO_2	REO[1]	BeO	Ta_2O_5
Ross Adams...	-	[2/] 3.36	[2/] 1.24	2.92	2.36	0.64	-	-	-	-	-	-	-	-	-	-
Sunday Lake..	-	-	-	-	-	-	-	-	0.04	1.97	0.32	0.56	0.20	0.20	-	-
ILM..........	-	-	-	-	-	-	-	-	1.51	-	0.14	0.93	27.30	3.23	-	-
Geiger.......	10.73	0.46	1.02	8.21	119.07	22.42	-	0.71	23.74	1.62	2.36	24.19	279.82	50.70	-	1.35
I & L........	0.26	0.48	0.04	-	14.86	-	-	-	0.10	-	-	-	-	-	-	-
Dotson.......	3.37	2.89	0.38	4.66	-	5.37	-	-	17.54	8.79	1.94	23.48	44.96	35.78	-	-
Cheri........	1.74	0.42	0.20	2.17	6.41	4.64	0.32	-	10.94	2.80	1.29	16.03	35.99	43.00	2.49	-
Upper Cheri..	-	-	-	-	-	-	-	-	0.95	0.24	0.13	1.53	4.42	3.95	-	-
Geoduck......	4.02	0.86	0.42	10.31	17.50	10.33	0.77	-	21.27	4.01	2.29	38.09	74.66	60.73	5.28	-
TOTAL	20.12	8.47	3.30	28.27	170.20	43.40	1.09	0.71	76.09	19.43	8.47	104.81	467.35	197.59	7.77	1.35

- Not determined.

[1] REO does not include yttrium.

1,510,000

*** CONCLUSIONS

Bokan Mountain is underlain by a multiple-phase peralkaline granite that has four types of related mineral deposits or occurrences.

Shear zones and fracture-controlled deposits are best typified by the Ross-Adams mine, which has produced uranium and contains remaining resources of thorium, uranium, and yttrium, but no appreciable columbium in a pipe-shaped ore body.

Pegmatites, the second type of deposit, are common: 1) within the peralkaline granite and range from small tabular bodies to larger convoluted sheets or pods, and 2) within the border zone pegmatite where they occur as linear bands and variable lenses subparallel to the contact of the Bokan intrusive complex. Typically, they have complex mineralogies and variably elevated quantities of gold, beryllium, columbium, hafnium, REE, tantalum, tin, titanium, thorium, uranium, yttrium, and zirconium.

The third type of deposit comprises over 35,000 ft of strike length along five systems of northwest trending mineralized dikes. These dikes radiate from the peralkaline granite into the country rock and contain complex suites of REE, beryllium, columbium, tantalum, thorium, yttrium, uranium, and other economic minerals.

Fourth, placer deposits associated with post-glacial sedimentation are suggested by geomorphic evidence and limited sampling data from surface sediments. However, no economic or subeconomic placer deposits were delineated.

Numerous prospects and mines and previously unreported mineralized occurrences were examined during this investigation. Nine of the prospects, six of which have not been previously described, were found to have sufficient size and grade to warrant estimation of indicated and/or inferred resources totaling:

8.86 MM lb BeO	96.21 MM lb Cb_2O_5
2.06 MM lb Ta_2O_5	27.90 MM lb ThO_2
11.77 MM lb U_3O_8	133.08 MM lb Y_2O_3
637.55 MM lb ZrO_2	240.99 MM lb REO

Above resource estimates are minimal values due to analytical limitations. The columbium resource amounts to approximately 10 years of domestic U.S. consumption. Mineralized dikes contain most of the total indicated and inferred resources of columbium and REO whereas shear zones and fracture-controlled deposits (i.e. the Ross-Adams mine) contain the major portion of the indicated thorium and uranium resources. The composition of REO in the Bokan Mountain deposits is shown to contain both the cerium (light) subgroup and the yttrium (heavy) subgroup in near equal proportions.

It is presently unclear if or how much of the valuable metals can be extracted from the Bokan deposits. Economic extraction of the columbium, REE, and other valuable commodities is dependent on metallurgical procedures that are currently being tested by the Bureau of Mines. The Bokan Mountain deposits contain numerous mineral commodities that likely will have to be simultaneously produced in order to approach economic viability.

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Appendix A.
Field Sample Numbers
Versus Map Numbers

Sample Number	Map Number
SE24712	1-17
SE24713	1-18
SE24714	1-19
SE24715	1-20
SE24716	1-21
SE24717	1-22
SE24718	1-23
SE24719	1-24
SE24720	1-25
SE24721	1-26
SE24711	1-27
SE23893	2-1
SE23863	2-2
SE23888	2-3
SE23889	2-4
SE23890	2-5
SE23891	2-6
SE23892	2-6
SE24084	3-1
SE24085	3-2
SE24083	3-3
SE24080	3-4
SE24079	3-5
SE24487	4-1
SE24088	4-2
SE24087	4-3
SE24882	4-4
SE24881	4-5
SE23490	4-6
SE23491	4-7
SE21752	4-8
SE21389	4-9
SE21390	4-10
SE21393	4-11
SE23897	5-1
SE23896	5-2
SE23895	5-3
SE23864	5-4
SE24092	5-5
SE24106	5-6
SE24093	5-7
SE24097	5-8
SE24086	5-9
SE24087	5-10
SE24089	5-11
SE23894	5-12
SE24094	5-13
SE24096	5-14
SE24219	6-1
SE24218	6-2
SE24213	6-3
SE24071	6-4
SE24073	6-5

Sample Number	Map Number
SE24072	6-6
SE24164	6-7
SE24075	6-8
SE24163	6-9
SE24212	6-10
SE24074	6-11
SE24649	6-12
SE24165	6-13
SE24221	6-14
SE24211	6-15
SE24070	6-16
SE24646	6-17
SE24160	6-18
SE24162	6-19
SE24645	6-20
SE24157	6-21
SE24158	6-22
SE24159	6-23
SE24647	6-24
SE24644	6-25
SE24220	6-26
SE23149	7-1
SE23150	7-2
SE23151	7-3
SE23152	7-4
SE23844	8-1
SE23848	8-2
SE23879	8-3
SE23880	8-4
SE23849	8-5
SE25061	9-1
SE25062	9-2
SE26437	9-3
SE24702	9-4
SE26402	9-5
SE26403	9-6
SE26438	9-7
SE26440	9-8
SE26439	9-9
SE24701	9-10
SE24700	9-11
SE26446	9-12
SE26447	9-13
SE26406	9-14
SE26407	9-15
SE26404	9-16
SE26444	9-17
SE26443	9-18
SE26442	9-19
SE26445	9-20
SE26441	9-21
SE26434	9-22

Sample Number	Map Number
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SE21754	9-24
SE26414	9-25
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SE23379	10-2
SE24651	10-3
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SE23397	10-5
SE23395	10-6
SE23393	10-7
SE23394	10-8
SE24108	10-9
SE24109	10-10
SE23408	10-11
SE24499	10-12
SE23415	10-13
SE23386	10-14
SE23387	10-15
SE23390	10-16
SE23391	10-17
SE23392	10-18
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SE24488	10-30
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SE21486	11-2
SE21487	11-3
SE21488	11-4
SE21828	11-5
SE21485	11-6
SE21484	11-7
SE21823	11-8
SE21824	11-9
SE21825	11-10
SE21826	11-11
SE21852	11-12
SE21853	11-13
SE21854	11-14
SE21480	11-15
SE21481	11-16
SE21482	11-17
SE21483	11-18

Sample Number	Map Number
SE21705	11-19
SE21706	11-20
SE21704	11-21
SE21850	11-22
SE21466	11-23
SE21447	11-24
SE21472	11-25
SE21473	11-26
SE21851	11-27
SE23838	11-28
SE21847	11-29
SE21848	11-30
SE21846	11-31
SE21476	11-32
SE21477	11-33
SE21474	11-34
SE21475	11-35
SE21844	11-36
SE21845	11-37
SE21451	11-38
SE21450	11-39
SE21444	11-40
SE21849	11-41
SE21452	11-42
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SE21449	11-44
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SE21442	11-46
SE21443	11-47
SE21445	11-48
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SE21395	12-5
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SE21397	12-7
SE21398	12-8
SE21399	12-9
SE21400	12-10
SE21749	12-11
SE21401	12-12
SE21402	12-13
SE21403	12-14
SE21404	12-15
SE21405	12-16
SE21406	12-17
SE21407	12-18
SE21408	12-19
SE21409	12-20
SE21750	12-21
SE21751	12-22
SE24166	12-23

Sample Number	Map Number	Sample Number	Map Number
SE24077	12-24	SE24685	12-77
SE24076	12-25	SE24687	12-78
SE24695	12-26	SE23332	12-79
SE21831	12-27	SE21767	12-80
SE21832	12-28	SE21768	12-81
SE21833	12-29	SE21769	12-82
SE21439	12-30	SE21770	12-83
SE21834	12-31	SE23251	12-84
SE21843	12-32	SE23252	12-85
SE21835	12-33	SE23339	12-86
SE21836	12-34	SE23340	12-87
SE21837	12-35	SE24658	13-1
SE21838	12-36	SE23338	13-2
SE24225	12-37	SE23336	13-3
SE21839	12-38	SE23337	13-4
SE21840	12-39	SE24063	13-5
SE21841	12-40	SE24062	13-6
SE21842	12-41	SE24061	13-7
SE23335	12-42	SE23883	13-8
SE23334	12-43	SE23884	13-9
SE23333	12-44	SE23885	13-10
SE23341	12-45	SE23898	13-11
SE23342	12-46	SE23899	13-12
SE23344	12-47	SE23900	13-13
SE23343	12-48	SE25058	13-14
SE23345	12-49	SE24059	13-15
SE21763	12-50	SE24060	13-16
SE21764	12-51	SE23372	13-17
SE23347	12-52	SE24668	13-18
SE23346	12-53	SE24224	13-19
SE24230	12-54	SE23371	13-20
SE24231	12-55	SE23370	13-21
SE24232	12-56	SE24636	13-22
SE21766	12-57	SE24214	14-1
SE21765	12-58	SE24215	14-2
SE24233	12-59	SE24216	14-3
SE24234	12-60	SE24637	14-4
SE24235	12-61	SE24638	14-5
SE24484	12-62	SE24639	14-6
SE24485	12-63	SE24640	14-7
SE21762	12-64	SE24641	14-8
SE23348	12-65	SE24238	14-9
SE21761	12-66	SE24239	14-10
SE21760	12-67	SE24242	14-11
SE21755	12-68	SE24243	14-12
SE21756	12-69	SE24244	14-13
SE21757	12-70	SE24245	14-14
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SE24683	12-73	SE23904	15-3
SE24681	12-74	SE23905	15-4
SE24682	12-75	SE23856	15-5
SE24684	12-76	SE23906	15-6

Sample Number	Map Number
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SE23907	15-8
SE23908	15-9
SE23858	15-10
SE23857	15-11
SE23912	15-12
SE23910	15-13
SE23859	15-14
SE23911	15-15
SE24248	15-16
SE24249	15-17
SE24250	15-18
SE24247	15-19
SE23483	15-20
SE23482	15-21
SE24665	15-22
SE24666	15-23
SE24667	15-24
SE23495	15-25
SE23494	15-26
SE23492	15-27
SE23493	15-28
SE24696	15-29
SE23497	15-30
SE23498	15-31
SE24669	15-32
SE24670	15-33
SE24671	15-34
SE24672	15-35
SE24680	15-36
SE24679	15-37
SE24241	15-38
SE24693	15-39
SE24694	15-40
SE24692	15-41
SE24691	15-42
SE24690	15-43
SE24689	15-44
SE24673	15-45
SE24674	15-46
SE24236	15-47
SE24237	15-48
SE24223	16-1
SE24635	16-2
SE24676	16-3
SE24668	16-4
SE24222	16-5
SE24677	16-6
SE24678	16-7
SE24217	16-8
SE23399	16-9
SE23398	16-10
SE23400	16-11

Sample Number	Map Number
SE26451	16-12
SE26418	16-13

Appendix B.

Additional analyses of samples reported in text.

EXPLANATION

(-) Not analyzed
I Interference

Ross Adams Mine

Element	1-1	1-2	1-3	1-4	1-5	1-6
	Concentration, Parts Per Million					
Ag	0.48	<20	3.78	<20	50	<30
As	<90	<200	<200	<200	300	<200
Au	<0.007	<20	0.033	<20	<20	<20
B	<70	100	100	100	100	100
Ba	50	<20	<20	30	80	40
Be	13	9	9	16	13	8
Bi	<100	<400	<200	<400	<400	<300
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<10	<10	<10	<10	<10	<10
Cr	<7	<8	<10	20	70	30
Cs	-	-	-	-	-	-
Cu	<6	<6	<6	<6	<6	<6
Ga	<2	30	<10	<10	20	<10
Ge	-	-	-	-	-	-
Hf	-	-	-	-	-	-
Li	<100	<20	<100	<20	<20	<20
Mo	<1	<1	<1	<1	<1	<1
Ni	<20	10	<20	10	20	20
Pb	<60	<50	<30	700	<50	<40
Pd	<1	<1	<1	<1	<1	<1
Pt	<6	<6	<6	<6	<6	<6
Rb	-	-	-	-	-	-
Sb	<600	<600	<600	<600	<600	<600
Sc	<4	<4	<4	<4	<4	<4
Se	-	-	-	-	-	-
Sn	<5	5.2	6	7.6	<5.0	<5.0
Sr	<1	5	<1	<1	<1	<1
Ta	<80	<100	<80	<100	<100	<100
Te	<400	<1000	<400	<600	<1000	<1000
V	<50	<50	<50	<50	<50	<50
W	-	-	-	-	-	-
Zn	500	300	50	200	300	200
	Concentration, Percent					
Al_2O_3	>9.5	>9.5	>7.6	>7.6	>9.5	>7.6
CaO	<0.07	2.8	<0.07	<0.14	<0.7	<0.07
Fe_2O_3	5.6	7.0	5.6	7.0	7.0	7.0
K_2O	>12.0	6.0	>12.0	12.0	7.2	9.6
MgO	0.012	0.016	0.016	0.008	0.016	0.008
MnO	0.13	0.26	0.39	0.13	0.26	0.26
Na_2O	7.8	13.0	13.0	13.0	13.0	13.0
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
SiO_2	>21.0	>21.0	>21.0	>21.0	>21.0	>21.0
TiO_2	0.05	0.17	0.12	0.7	0.15	<0.08
LOI	-	-	-	-	-	-

Ross Adams Mine - Continued

Element	1-7	1-8	1-9	1-10	1-11	1-12
	Concentration, Parts Per Million					
Ag	60	<40	<50	<40	<30	<40
As	<300	<100	300	300	<200	400
Au	<20	<20	<20	<20	<20	<20
B	100	<80	100	100	100	100
Ba	70	50	30	<20	200	600
Be	9	8	7	8	9	8
Bi	<400	<500	<500	<300	<500	<700
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<10	<10	<10	<10	<10	<10
Cr	30	10	50	50	10	10
Cs	-	-	-	-	-	-
Cu	<6	<6	<6	<6	<6	<6
Ga	20	30	20	20	30	40
Ge	-	-	-	-	-	-
Hf	-	-	-	-	-	-
Li	<20	<20	<20	<20	<200	<20
Mo	<1	<1	<1	<1	<1	<1
Ni	30	20	20	20	20	30
Pb	<50	<20	<70	<50	<40	100
Pd	<1	<1	<1	<1	<1	<1
Pt	<7	<6	<6	<6	<6	<7
Rb	-	-	-	-	-	-
Sb	<600	<600	<600	<600	<800	<600
Sc	<4	<4	<4	<4	<4	<4
Se	-	-	-	-	-	-
Sn	<5.0	<5.0	<5.0	<5.0	10.0	25.9
Sr	<1	<1	<1	<1	<1	6
Ta	<100	<100	<100	<100	<100	<100
Te	1000	<400	1000	1000	1000	<900
V	<50	<50	<50	<50	<50	<50
W	-	-	-	-	-	-
Zn	200	100	200	300	100	200
	Concentration, Percent					
Al_2O_3	>9.5	>9.5	>9.5	>7.6	>9.5	>9.5
CaO	<0.07	<0.07	0.28	0.28	<0.07	0.84
Fe_2O_3	7.0	7.0	7.0	6.6	8.4	7.0
K_2O	6.0	<2.4	12.0	4.8	8.4	4.8
MgO	0.014	0.011	0.010	0.008	0.010	0.048
MnO	0.26	0.26	0.13	0.13	0.91	0.39
Na_2O	10.4	13.0	13.0	13.0	13.0	13.0
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
SiO_2	>21.0	>21.0	>21.0	>21.0	>21.0	>21.0
TiO_2	0.14	0.17	0.14	<0.8	0.17	<0.17
LOI	-	-	-	-	-	-

Element	1-13	1-14	1-15	1-16	1-17	1-18
			Concentration, Parts Per Million			
Ag	<30	100	<10	90	<0.5	<0.5
As	<200	<300	<200	400	<2	<2
Au	<20	<20	<20	<20	0.010	<0.10
B	<70	100	100	200	40	40
Ba	90	200	<20	10	190	140
Be	9	9	6	9	<10	<10
Bi	<200	<600	<300	<300	<0.5	<0.5
Br	-	-	-	-	<1	1
Cd	<5	<5	<5	<5	<0.2	<0.2
Co	<10	<10	<10	<10	1	1
Cr	30	20	30	10	30	30
Cs	-	-	-	-	0.7	0.6
Cu	<6	<6	<6	<6	26	13
Ga	20	40	<10	40	-	-
Ge	-	-	-	-	10	10
Hf	-	-	-	-	69	29
Li	<20	<20	200	>2000	30	20
Mo	<1	<1	<1	<1	<5	<5
Ni	20	20	20	40	2	1
Pb	<30	<50	<30	100	22	12
Pd	<1	<1	<1	<1	-	-
Pt	<6	<20	<6	<20	-	-
Rb	-	-	-	-	160	<20
Sb	<600	<600	<600	<600	<0.2	<0.2
Sc	<4	<4	<4	<4	0.32	0.36
Se	-	-	-	-	14	10
Sn	17.9	15.5	7.6	<5.0	-	-
Sr	<1	<1	<1	<1	20	<20
Ta	<100	<100	<100	<100	6	7
Te	<600	<1000	<1000	1000	-	-
V	<50	<50	<50	<50	20	10
W	-	-	-	-	<3	<3
Zn	200	100	300	400	360	250
			Concentration, Percent			
Al_2O_3	>9.5	>7.6	>7.6	>9.5	11.1	11.2
CaO	0.42	0.28	<0.07	0.56	0.48	0.30
Fe_2O_3	7.0	8.4	5.6	7.0	3.88	3.95
K_2O	4.8	7.2	>12.0	>12.0	4.2	2.91
MgO	0.032	0.048	0.016	0.016	0.04	0.03
MnO	0.39	0.26	0.13	0.26	0.14	0.06
Na_2O	13.0	13.0	7.8	9.1	5.44	6.58
P_2O_5	<1.6	<1.6	<1.6	<1.6	0.02	0.01
SiO_2	>21.0	>21.0	>21.0	>21.0	72.7	73.4
TiO_2	0.17	0.17	<0.05	0.17	0.16	0.19
	-	-	-	-	1.08	0.47

Ross Adams Mine - Continued

Element	1-19	1-20	1-21	1-22	1-23	1-24
	Concentration, Parts Per Million					
Ag	2.5	<0.5	<0.05	<0.05	<0.5	<0.5
As	<2	I	I	<2	I	I
Au	I	I	I	<0.010	I	I
B	30	40	40	30	30	40
Ba	280	160	120	130	140	120
Be	20	10	120	<10	10	10
Bi	5.0	<0.5	<0.5	<0.5	<0.5	<0.5
Br	<2	<2	I	<1	I	<4
Cd	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
Co	1	1	1	<1	1	3
Cr	90	110	70	30	40	60
Cs	<2.0	<0.5	<2.0	<0.5	1.0	1.4
Cu	12	15	6.0	6.5	5.5	3.5
Ga	-	-	-	-	-	-
Ge	10	10	<10	<10	<10	<10
Hf	21	40	10	3	31	28
Li	20	20	20	20	10	<10
Mo	I	I	140	<5	I	I
Ni	9	5	3	1	4	7
Pb	2500	70	92	26	48	110
Pd	-	-	-	-	-	-
Pt	-	-	-	-	-	-
Rb	<20	<20	<20	210	<20	270
Sb	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sc	0.45	0.80	0.60	0.02	1.53	1.40
Se	I	I	I	<3	<4	<4
Sn	-	-	-	-	-	-
Sr	200	<20	30	<20	<20	<20
Ta	4	17	5	<1	6	6
Te	-	-	-	-	-	-
V	40	10	20	10	20	30
W	I	I	I	I	I	I
Zn	2400	240	270	390	190	120
	Concentration, Percent					
Al_2O_3	12.0	11.7	12.2	11.4	15.2	15.2
CaO	0.56	0.44	0.24	0.27	0.16	0.17
Fe_2O_3	3.81	4.50	4.89	3.80	6.04	5.40
K_2O	0.28	0.39	0.23	2.94	0.24	0.06
MgO	0.05	0.05	0.06	0.03	0.04	0.03
MnO	0.15	0.17	0.21	0.06	0.14	0.10
Na_2O	8.39	8.14	9.19	7.00	12.1	11.8
P_2O_5	0.02	0.01	0.02	0.01	0.01	0.02
SiO_2	69.4	72.0	70.4	74.1	64.5	64.2
TiO_2	0.22	0.27	0.27	0.18	0.38	0.37
LOI	1.93	0.93	1.16	0.39	0.47	0.54

Ross Adams Mine - Continued

Element	1-25	1-26	1-27			
	Concentration, Parts Per Million					
Ag	<0.5	<0.5	<0.05			
As	I	<2	I			
Au	I	0.010	<0.040			
B	40	30	30			
Ba	210	110	130			
Be	10	20	20			
Bi	<0.5	<0.5	<0.5			
Br	<10	1	8			
Cd	<0.2	<0.2	<0.2			
Co	1	1	2			
Cr	60	40	130			
Cs	0.5	0.7	<0.8			
Cu	4.5	9.5	13			
Ga	-	-	-			
Ge	<10	<10	10			
Hf	35	55	20			
Li	10	10	20			
Mo	I	13	I			
Ni	4	1	5			
Pb	380	6	90			
Pd	-	-	-			
Pt	-	-	-			
Rb	<20	<20	<20			
Sb	<0.2	<0.2	<0.2			
Sc	1.19	1.54	1.5			
Se	<3	27	<3			
Sn	-	-	-			
Sr	<20	<20	<20			
Ta	7	9	1			
Te	-	-	-			
V	30	20	30			
W	I	-	I			
Zn	230	130	140			
	Concentration, Percent					
Al_2O_3	15.2	16.3	13.8			
CaO	0.34	0.10	0.62			
Fe_2O_3	4.76	4.32	5.82			
K_2O	0.31	0.17	0.36			
MgO	0.05	0.04	0.11			
MnO	0.12	0.13	0.13			
Na_2O	10.4	10.9	9.09			
P_2O_5	0.02	0.01	0.02			
SiO_2	61.9	66.0	66.8			
TiO_2	0.33	0.31	0.31			
LOI	5.77	1.39	1.54			

Sunday Lake

Element	2-1	2-2	2-3	2-4	2-5	2-6
			Concentration, Parts Per Million			
Ag	<0.3	9.08	1.14	0.44	2.68	0.8
As	<600	<400	<700	<900	<600	<90
Au	<0.007	0.441	<0.007	<0.007	<0.007	<0.007
B	<80	<60	100	200	100	<30
Ba	50	90	40	200	200	500
Be	18	140	23	540	120	46
Bi	<200	<100	<100	<400	<100	<300
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<10	<10	<10	<10	<10	<10
Cr	20	<4	<3	10	<3	<10
Cs	-	-	-	-	-	-
Cu	<6	10	<6	6	<6	<6
Ga	<2	<2	<2	<2	<2	<4
Ge	-	-	-	-	-	-
Hf	-	-	-	-	-	I
Li	<20	<20	<20	<20	<20	<20
Mo	<1	<1	<1	<1	<1	<2
Ni	10	200	<5	200	100	2000
Pb	2000	2000	700	1000	700	10000
Pd	<1	<1	<1	<1	<1	0.007
Pt	<6	<6	<6	<6	<6	<0.001
Rb	-	-	-	-	-	-
Sb	<600	<600	<600	<600	<600	<1000
Sc	<4	<4	<4	<4	<4	<4
Se	-	-	-	-	-	-
Sn	<5	<5	<5	<5	20.2	<5
Sr	3	300	<1	1000	2000	8
Ta	100	<80	<80	100	100	100
Te	<400	<400	<400	<400	<400	<400
V	<50	<50	<50	<50	<50	300
W	-	-	-	-	-	-
Zn	1000	5000	200	20	300	6000
			Concentration, Percent			
Al_2O_3	0.15	>5.7	>7.6	0.38	>7.6	1.52
CaO	<0.07	1.4	<0.07	0.56	9.8	<0.14
Fe_2O_3	5.6	11.2	2.8	0.8	4.2	14.0
K_2O	<1.2	10.8	>12.0	<1.1	6.0	>12.0
MgO	0.01	0.10	0.02	0.003	0.10	0.48
MnO	0.13	0.52	0.03	0.01	0.09	>2.6
Na_2O	<0.4	<5.2	7.8	<0.4	11.7	<3.9
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
SiO_2	>21.0	>21.0	>21.0	>21.0	>21.0	>21.0
TiO_2	<0.05	0.68	<0.05	<0.05	<0.05	3.4
LOI	-	-	-	-	-	-

Sunday Lake - Continued

Element	2-7					
	Concentration, Parts Per Million					
Ag	<0.3					
As	<700					
Au	<0.007					
B	90					
Ba	<20					
Be	6					
Bi	<100					
Br	-					
Cd	<5					
Co	<10					
Cr	20					
Cs	-					
Cu	<6					
Ga	<2					
Ge	-					
Hf	-					
Li	<20					
Mo	<1					
Ni	50					
Pb	1000					
Pd	<1					
Pt	<6					
Rb	-					
Sb	<600					
Sc	<4					
Se	-					
Sn	<5					
Sr	<1					
Ta	100					
Te	<400					
V	<50					
W	-					
Zn	700					
	Concentration, Percent					
Al_2O_3	>7.6					
CaO	<0.07					
Fe_2O_3	8.4					
K_2O	2.4					
MgO	0.06					
MnO	0.26					
Na_2O	<1.2					
P_2O_5	<1.6					
SiO_2	>21.0					
TiO_2	<0.34					
LOI	-					

I and L No. 1

Element	3-1	3-2	3-3			
	Concentration, Parts Per Million					
Ag	<0.3	0.45	0.65			
As	<300	<200	<100			
Au	0.039	<0.007	<0.007			
B	100	100	90			
Ba	100	40	50			
Be	6	5	7			
Bi	<100	<100	<200			
Br	-	-	-			
Cd	<5	<5	<5			
Co	<10	<10	<10			
Cr	90	30	<8			
Cs	-	-	-			
Cu	<6	<6	<6			
Ga	20	<10	<10			
Ge	-	-	-			
Hf	-	-	-			
Li	<20	<20	<20			
Mo	<1	<1	<1			
Ni	20	20	40			
Pb	<50	<30	<50			
Pd	<1	<1	<1			
Pt	<7	<6	<6			
Rb	-	-	-			
Sb	<600	<600	<700			
Sc	<4	<4	<4			
Se	-	-	-			
Sn	<5	<5	<5			
Sr	<1	<1	<1			
Ta	<80	<80	<80			
Te	<40	<40	<40			
V	<50	<50	<50			
W	-	-	-			
Zn	200	200	800			
	Concentration, Percent					
Al_2O_3	>9.5	>9.5	>7.6			
CaO	<0.07	<0.07	<0.07			
Fe_2O_3	5.6	5.6	5.6			
K_2O	>12.0	>12.0	>12.0			
MgO	0.016	0.001	0.016			
MnO	1.17	0.26	0.13			
Na_2O	11.7	7.8	11.7			
P_2O_5	<1.6	<1.6	<1.6			
SiO_2	>21.0	>21.0	>21.0			
TiO_2	0.14	<0.05	<0.08			
LOI	-	-	-			

Weenie

Element	3-4	3-5				
	Concentration, Parts Per Million					
Ag	0.44	0.43				
As	<500	900				
Au	<0.007	0.043				
B	<100	300				
Ba	1000	50				
Be	64	6				
Bi	<100	<100				
Br	-	-				
Cd	<5	<5				
Co	50	<10				
Cr	20	300				
Cs	-	-				
Cu	<6	<6				
Ga	<8	60				
Ge	-	-				
Hf	-	-				
Li	<20	<20				
Mo	<1	<1				
Ni	200	100				
Pb	<80	200				
Pd	<1	<1				
Pt	<40	<6				
Rb	-	-				
Sb	<2000	<2000				
Sc	<4	<4				
Se	-	-				
Sn	<5	<5				
Sr	4000	3				
Ta	<80	<80				
Te	<400	<600				
V	<50	<50				
W	-	-				
Zn	1000	300				
	Concentration, Percent					
Al_2O_3	>7.6	>9.5				
CaO	<1.4	<0.07				
Fe_2O_3	7	8.4				
K_2O	>12.0	>12.0				
MgO	<0.010	0.005				
MnO	<13	<3.9				
Na_2O	13	11.7				
P_2O_5	6.9	4.6				
SiO_2	>21.0	>21.0				
TiO_2	0.14	<0.14				
LOI	-	-				

Other Shear Zones and Fracture-Related Deposits

Element	4-1	4-2	4-3	4-4	4-5	4-6
	Concentration, Parts Per Million					
Ag	<0.5	<0.03	<0.03	<0.03	<0.03	<0.5
As	<0.5	<200	<90	<90	<90	<2
Au	<0.01	0.032	0.162	<0.007	<0.007	0.040
B	10	100	<70	100	100	<10
Ba	140	<20	30	90	<20	120
Be	10	6	11	24	6	<10
Bi	0.5	<200	<100	<200	<200	0.5
Br	1	-	-	-	-	1
Cd	<0.2	<5	<5	<5	<5	0.8
Co	1	<10	<10	<10	<10	1
Cr	10	<7	40	20	<8	10
Cs	0.9	-	-	-	-	-
Cu	1.5	<6	<6	6	<6	1.5
Ga	-	<2	<2	<8	<10	-
Ge	<10	-	-	-	-	<10
Hf	41	-	-	-	-	78
Li	<10	200	<20	>500	<20	30
Mo	<5	<1	<1	<1	<1	<5
Ni	1	10	10	<3	<4	1
Pb	70	<40	<20	<40	<3	48
Pd	-	<1	<1	<1	<1	-
Pt	-	<6	<6	<6	<6	-
Rb	270	-	-	-	-	280
Sb	0.3	<600	<600	<600	<600	<0.2
Sc	0.58	<4	<4	<4	<4	0.4
Se	4	-	-	-	-	<3
Sn	-	<5	<5	6	13	-
Sr	20	<1	<1	<1	<1	<20
Ta	5	<80	<80	<80	<80	7
Te	-	<400	<400	<400	<400	-
V	<10	<50	<50	<50	<50	<10
W	3	-	-	-	-	<3
Zn	210	600	300	900	300	290
	Concentration, Percent					
Al_2O_3	11.1	>7.6	>7.6	>9.5	>9.5	10.5
CaO	0.52	<0.07	<0.07	<0.07	<0.07	0.16
Fe_2O_3	4.29	6.6	4.2	5.6	4.2	4.33
K_2O	4.29	>12.0	>12.0	>12.0	>12.0	4.32
MgO	<0.01	0.002	0.011	0.010	0.006	0.01
MnO	0.08	0.08	0.26	0.39	0.13	0.13
Na_2O	3.90	9.1	6.5	11.7	9.1	4.99
P_2O_5	0.07	<1.6	<1.6	<1.6	<1.6	0.02
SiO_2	72.6	>21.0	>21.0	>21.0	>21.0	74.8
TiO_2	0.14	<0.05	<0.05	<0.05	<0.05	0.16
LOI	1.7	-	-	-	-	0.39

Other Shear Zones and Fracture-Related Deposits - Continued

Element	4-7	4-8	4-9	4-10	4-11
			Concentration, Parts Per Million		
Ag	<0.5	<30	<20	<20	80
As	<2	<200	<200	<200	500
Au	0.10	<20	<20	<20	<40
B	<10	100	90	100	200
Ba	150	700	600	600	4000
Be	10	33	78	200	22
Bi	<0.5	<300	<400	<400	<300
Br	<1	-	-	-	-
Cd	<0.2	<5	<5	<5	<5
Co	1	<10	<10	<10	<10
Cr	10	30	<5	20	50
Cs	-	-	-	-	-
Cu	1.0	<6	<6	6	<6
Ga	-	<2	<2	<7	30
Ge	<10	-	-	-	-
Hf	46	-	-	-	-
Li	110	<20	>400	>300	<20
Mo	<5	<1	<1	<1	<1
Ni	1	20	20	10	30
Pb	20	<30	90	<60	100
Pd	-	<1	<1	<1	<1
Pt	-	<6	<6	<6	<10
Rb	310	-	-	-	-
Sb	0.2	<600	<600	<600	<600
Sc	0.3	<4	<4	<4	<4
Se	<3	-	-	-	-
Sn	-	<5	6.9	<5	<5
Sr	<20	40	40	20	70
Ta	7	<100	<100	<100	<100
Te	-	<1000	<500	<500	1000
V	<10	<50	<50	<50	<90
W	3	-	-	-	-
Zn	210	40	300	60	20
			Concentration, Percent		
31_2O_3	12.5	>7.6	>7.6	>9.5	>11.4
CaO	0.14	7.0	1.4	0.42	2.6
Fe_2O_3	3.22	4.2	6.5	5.6	6.5
K_2O	4.56	4.8	7.2	7.2	7.2
MgO	0.01	1.3	1.6	1.4	1.4
MnO	0.08	0.4	1.0	0.4	0.7
Na_2O	5.73	6.5	11.7	13.0	9.1
P_2O_5	0.02	<1.6	<1.6	<1.6	<1.6
SiO_2	71.9	>21.0	>21.0	>21.0	>21.0
TiO_2	0.18	<0.12	0.34	0.34	0.34
LOI	0.54	-	-	-	-

Northwest Bokan Mountain

Element	5-1	5-2	5-3	5-4	5-5	5-6
			Concentration, Parts Per Million			
Ag	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
As	<900	<800	<1000	<90	<100	<90
Au	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007
B	100	100	200	100	100	90
Ba	200	300	200	100	70	100
Be	4	12	130	140	16	17
Bi	<100	<300	<100	<100	<200	<100
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<10	<10	<10	<10	<10	<10
Cr	<30	<10	50	80	20	50
Cs	-	-	-	-	-	-
Cu	<6	<6	<6	<6	<6	<6
Ga	20	<2	<5	20	<2	<2
Ge	-	-	-	-	-	-
Hf	72	-	600	-	-	260
Li	<20	<20	<20	<20	<20	<20
Mo	<1	<1	<1	<1	<1	<1
Ni	<10	<5	<7	20	10	8
Pb	<60	<60	400	200	<30	<20
Pd	<1	<1	<1	<1	<1	<1
Pt	<2	<10	<7	<40	<6	<20
Rb	-	-	-	-	-	-
Sb	<600	<600	<600	<600	<600	<600
Sc	<4	<4	<4	<4	<4	<4
Se	-	-	-	-	-	-
Sn	<5	<5	35	9	<5	<5
Sr	<1	2	<1	<1	<1	50
Ta	100	100	100	100	<80	<80
Te	<400	<400	<400	<400	<400	<400
V	200	<50	<50	<50	<50	<50
W	-	-	-	-	-	-
Zn	<2	100	600	300	20	40
			Concentration, Percent			
Al_2O_3	>11.4	>9.5	>7.6	>7.6	>5.7	>5.7
CaO	<0.07	<0.07	<0.07	<0.07	0.014	0.42
Fe_2O_3	2.8	5.6	7.0	7.0	2.8	2.8
K_2O	<0.7	<0.7	>12.0	>12.0	>12.0	>12.0
MgO	0.32	1.6	0.010	0.14	0.048	0.32
MnO	0.05	>2.6	1.04	0.13	0.26	0.39
Na_2O	10.4	7.8	<0.39	6.5	7.8	<0.39
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.62
SiO_2	>21.0	>21.0	>21.0	>21.0	>21.0	>21.0
TiO_2	0.17	0.17	0.17	0.68	<0.05	<0.05
LOI	-	-	-	-	-	-

Element	5-7	5-8	5-9	5-10	5-11	5-12
			Concentration, Parts Per Million			
Ag	<0.3	<0.3	<0.3	22.5	10.08	<0.3
As	<600	<90	<90	<90	<90	<500
Au	<0.007	<0.007	<0.007	71.48	1.30	<0.007
B	90	<70	<80	<60	<60	<100
Ba	30	<20	<20	200	<20	500
Be	2	6	4	8	7	7
Bi	<100	<100	<100	<100	<100	<200
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<10	<10	<10	<10	<10	<10
Cr	30	30	50	<7	40	<3
Cs	-	-	-	-	-	-
Cu	<6	<6	<6	<6	<6	<6
Ga	<2	<2	<2	<2	<2	<2
Ge	-	-	-	-	-	-
Hf	-	1600	-	-	-	750
Li	<20	<20	<20	<20	<20	<20
Mo	<1	<1	<1	<1	<1	<1
Ni	<7	20	<3	10	20	<30
Pb	<20	<20	<20	1000	2000	<20
Pd	<1	<1	<1	<1	<1	<1
Pt	<6	<200	<6	<6	<6	<10
Rb	-	-	-	-	-	-
Sb	<600	<600	<600	<600	<600	<600
Sc	<4	<4	<4	<4	<4	<4
Se	-	-	-	-	-	-
Sn	<5	<5	<5	<5	<5	<5
Sr	<1	<1	<1	5	700	<1
Ta	<80	<80	<80	<80	<80	<80
Te	<400	<400	<400	<400	<400	<400
V	<50	<50	<50	<50	50	<300
W	-	-	-	-	-	-
Zn	20	90	30	1000	100	100
			Concentration, Percent			
Al_2O_3	>3.8	1.7	0.6	>7.6	0.6	1.7
CaO	<0.07	<0.07	<0.07	1.26	8.4	<0.07
Fe_2O_3	1.1	7.0	1.4	5.6	5.6	14.0
K_2O	>12.0	>12.0	7	>12.0	>12.0	12.0
MgO	0.064	0.002	0.0005	0.0013	0.0006	<0.13
MnO	0.08	0.13	0.04	0.12	0.01	>13
Na_2O	<3.9	2.6	<0.39	7.8	<0.4	<0.4
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
SiO_2	>21.0	>21.0	>21.0	>21.0	>21.0	>21.0
TiO_2	<0.05	<0.12	<0.05	<0.05	<0.008	<0.05
LOI	-	-	-	-	-	-

Northwest Bokan Mountain - Continued

Element	5-13	5-14				
	Concentration, Parts Per Million					
Ag	0.46	1.526				
As	<90	<90				
Au	<0.007	<0.007				
B	<40	<40				
Ba	3000	300				
Be	9	14				
Bi	<300	<100				
Br	-	-				
Cd	<5	<5				
Co	<10	<10				
Cr	<3	20				
Cs	-	-				
Cu	<6	10				
Ga	<2	<2				
Ge	-	-				
Hf	-	-				
Li	<20	>6000				
Mo	<1	<1				
Ni	<2	40				
Pb	<20	2000				
Pd	<1	<1				
Pt	<6	<6				
Rb	-	-				
Sb	<600	<600				
Sc	<4	<4				
Se	-	-				
Sn	<5	<5				
Sr	4	50				
Ta	<80	<80				
Te	<400	<400				
V	<50	<50				
W	-	-				
Zn	<1	1000				
	Concentration, Percent					
Al_2O_3	>5.7	>5.7				
CaO	1.4	7.0				
Fe_2O_3	4.2	8.4				
K_2O	>12.0	>12.0				
MgO	1.6	3.2				
MnO	>6.5	4.2				
Na_2O	<0.4	13				
P_2O_5	<1.6	<1.6				
SiO_2	>21.0	>21.0				
TiO_2	<0.12	<0.51				
LOI	-	-				

ILM Prospect

Element	6-1	6-2	6-3	6-4	6-5	6-6
			Concentration, Parts Per Million			
Ag	<0.5	<0.5	<0.5	<0.3	<0.3	0.59
As	2	<2	<2	<200	<300	<90
Au	0.01	0.02	0.01	<0.007	<0.007	<0.007
B	<10	<10	<10	100	100	90
Ba	110	200	100	80	<20	200
Be	10	10	<10	17	7	26
Bi	2	2.5	<0.5	<100	<100	<100
Br	1	<2	1	-	-	-
Cd	<0.2	<0.2	<0.2	<5	<5	<5
Co	1	<1	1	<1	<1	<1
Cr	20	30	20	30	30	60
Cs	1	1.1	0.8	-	-	-
Cu	1.5	4.0	1.0	<6	<6	<6
Ga	-	-	-	<2	<4	<2
Ge	20	30	<10	-	-	-
Hf	320	630	12	340	-	500
Li	80	40	170	<20	>500	<20
Mo	<5	<5	<5	<1	<1	<1
Ni	1	4	<1	20	20	<6
Pb	34	100	2	200	<20	<80
Pd	-	-	-	<1	<1	<1
Pt	-	-	-	<6	<6	<80
Rb	420	440	310	-	-	-
Sb	1.1	2.2	0.2	<600	<600	<600
Sc	0.2	0.3	0.3	<4	<4	<4
Se	<5	<3	<3	-	-	-
Sn	-	-	-	83	<5	59
Sr	<20	<20	<20	200	<1	300
Ta	17	22	2	<80	<80	90
Te	-	-	-	<400	<400	<400
V	10	10	10	<50	<50	<50
W	3	<3	<3	-	-	-
Zn	280	590	200	600	300	2000
			Concentration, Percent			
Al_2O_3	9.32	6.01	11.5	>5.7	>7.6	1.9
CaO	0.04	0.11	0.06	<0.07	<0.07	<0.07
Fe_2O_3	3.99	4.95	4.21	7.0	7.0	5.6
K_2O	4.54	3.87	4.12	>12.0	>12.0	>12.0
MgO	0.04	0.09	0.02	0.0004	0.01	<0.0005
MnO	0.11	0.18	0.09	0.26	0.26	>5.2
Na_2O	3.82	2.04	5.53	<0.39	5.2	<0.39
P_2O_5	0.03	0.03	0.02	<1.6	<1.6	<1.6
SiO_2	75.4	76.3	74.3	>21.0	>21.0	>21.0
TiO_2	0.26	0.22	0.12	0.17	<0.05	0.07
LOI	0.93	2.04	0.39	-	-	-

ILM Prospect - Continued

Element	6-7	6-8	6-9	6-10	6-11	6-12
			Concentration, Parts Per Million			
Ag	<0.3	0.39	<0.3	<0.5	4.495	<0.05
As	<90	<90	<200	<2	<90	1.7
Au	<0.007	<0.007	<0.007	<10	<0.007	0.01
B	100	<80	<60	<10	<70	20
Ba	20	80	90	90	80	190
Be	10	26	12	10	15	10
Bi	<100	<100	<100	<0.5	<100	0.5
Br	-	-	-	1	-	1
Cd	<5	<5	<5	<0.2	<5	<0.2
Co	<1	<1	<1	1	<10	<1
Cr	40	30	10	10	30	10
Cs	-	-	-	0.7	-	1.5
Cu	<6	<6	<6	1.0	<6	1.0
Ga	<2	<2	<2	-	<4	-
Ge	-	-	-	<10	-	10
Hf	-	530	420	16	400	210
Li	>700	<20	<20	180	<20	30
Mo	<1	<1	<1	<5	<1	<5
Ni	10	10	10	<1	20	3
Pb	<20	<20	<50	20	<40	50
Pd	<1	<1	<1	-	<1	-
Pt	<6	<20	<6	-	<6	-
Rb	-	-	-	390	-	420
Sb	<600	<600	<600	0.3	<600	0.9
Sc	<4	<4	<4	0.4	<4	0.25
Se	-	-	-	<3	-	<3
Sn	<5	52	90	-	61	-
Sr	<1	3	7	<20	500	40
Ta	<80	<80	<80	4	<80	28
Te	<400	<400	<400	-	<400	-
V	<50	<50	<50	10	<50	<10
W	-	-	-	<3	-	<3
Zn	600	400	500	300	1000	280
			Concentration, Percent			
Al_2O_3	>7.6	>5.7	>3.8	11.7	>7.6	9.17
CaO	<0.07	<0.07	<0.28	0.06	<0.05	0.04
Fe_2O_3	5.6	5.6	5.6	4.97	7.0	3.77
K_2O	>12	>12	>12	4.66	>12.0	4.54
MgO	0.013	0.0006	<0.0002	0.02	0.011	<0.01
MnO	0.26	0.12	0.39	0.07	0.26	0.01
Na_2O	10.4	1.2	<0.39	5.54	5.2	2.94
P_2O_5	<1.6	<1.6	<1.6	0.02	<1.6	0.02
SiO_2	>21	>21	>21	71.8	>21.0	76.6
TiO_2	<0.05	1.0	0.34	0.16	<0.05	0.29
LOI	-	-	-	0.93	-	1.31

ILM Prospect - Continued

Element	6-13	6-14	6-15	6-16	6-17	6-18
			Concentration, Parts Per Million			
Ag	<0.3	<0.5	<0.5	11.16	<0.5	2.742
As	<90	<2	8	<90	1.6	10000
Au	<0.007	<0.01	0.03	0.118	<0.01	0.604
B	<70	<10	10	100	20	100
Ba	2000	I	170	100	90	200
Be	150	10	90	6	10	38
Bi	<100	0.5	1.0	<100	0.5	<100
Br	-	1	<1	-	1	-
Cd	<5	<0.2	<0.2	<5	<0.2	<5
Co	<10	1	1	<10	1	<10
Cr	20	I	30	20	10	30
Cs	-	0.9	0.5	-	1.8	-
Cu	<6	<0.5	3.0	<6	0.5	<6
Ga	<2	-	-	<2	-	<2
Ge	-	10	40	-	10	-
Hf	660	39	630	670	37	710
Li	<20	830	30	-	160	<20
Mo	<1	<5	<5	<1	<5	<1
Ni	30	<1	7	20	1	20
Pb	100	10	290	<70	20	<80
Pd	<1	-	-	<1	-	<1
Pt	100	-	-	<80	-	<6
Rb	-	I	270	-	340	-
Sb	<600	0.3	3.8	<600	0.3	<600
Sc	<4	1.4	0.7	<4	8	<4
Se	-	<5	<50	-	3	-
Sn	98	-	-	50	-	26.9
Sr	1000	I	70	30	<20	20
Ta	<80	4	42	<80	7	<80
Te	<400	-	-	<400	-	<400
V	<50	<10	20	<50	<10	<50
W	-	<3	<3	-	<3	-
Zn	400	1100	340	200	310	400
			Concentration, Percent			
Al_2O_3	0.76	I	6.33	1.71	9.73	>5.7
CaO	<0.56	I	1.59	<0.14	0.06	0.7
Fe_2O_3	5.6	I	4.86	7.0	4.70	5.6
K_2O	12	I	2.73	>12	3.68	>12
MgO	0.0002	I	0.14	<0.0002	<0.01	<0.0003
MnO	0.12	I	0.21	0.26	0.07	0.26
Na_2O	<0.39	I	3.17	<0.39	5.09	<0.39
P_2O_5	<1.6	I	0.08	<1.6	0.02	<1.6
SiO_2	>21	I	73.5	>21	74.5	>21
TiO_2	0.15	I	0.64	1.19	0.17	1.7
LOI	-	I	1.62	-	0.85	-

ILM Prospect - Continued

Element	6-19	6-20	6-21	6-22	6-23	6-24
	Concentration, Parts Per Million					
Ag	<0.3	<0.5	<0.33	0.35	<0.03	<0.5
As	<90	0.87	300	<100	<200	<0.63
Au	<0.007	<0.01	<0.007	<0.007	<0.007	<0.01
B	90	20	100	100	100	20
Ba	<20	100	<20	40	300	100
Be	24	10	27	110	380	10
Bi	<100	0.5	<100	<100	<100	<0.5
Br	-	1	-	-	1	<1
Cd	<5	<0.2	<5	<5	<5	<0.2
Co	<10	1	<10	<10	<10	<1
Cr	40	10	80	20	50	10
Cs	-	0.9	-	-	-	1.7
Cu	<6	<0.5	<6	<6	<6	0.5
Ga	<2	-	<2	<2	<2	-
Ge	-	10	-	-	-	10
Hf	620	31	-	600	180	46
Li	<20	160	200	<20	200	280
Mo	<1	<5	<1	<1	<1	<5
Ni	10	2	20	20	20	1
Pb	<20	8	<40	100	<50	36
Pd	<1	-	<1	<1	<1	-
Pt	<6	-	<6	<6	<6	-
Rb	-	320	-	-	-	310
Sb	<600	0.2	<600	<600	<600	0.2
Sc	<4	0.45	<4	<4	<4	0.54
Se	-	<3	-	-	-	<3
Sn	48	-	<5	120	25	-
Sr	<1	<20	<1	50	100	<20
Ta	<80	4	<80	<80	<80	7
Te	<400	-	<400	<400	<400	-
V	<50	<10	<50	<50	<50	<10
W	-	<3	-	-	-	<3
Zn	600	240	900	800	700	480
	Concentration, Percent					
Al_2O_3	>7.6	10.6	>7.6	>3.8	>7.6	9.92
CaO	<0.07	0.06	<0.07	<0.14	<0.12	0.12
Fe_2O_3	2.8	4.40	5.6	5.6	5.6	5.96
K_2O	>12	4.07	>12	>12	>12	3.52
MgO	0.0002	<0.01	<0.008	<0.0002	0.002	<0.01
MnO	0.06	0.08	0.26	0.39	0.39	0.11
Na_2O	<1.3	4.84	11.7	<0.39	3.9	5.30
P_2O_5	<1.6	0.02	<1.6	<1.6	<1.6	0.02
SiO_2	>21	74.9	>21	>21	>21	74.1
TiO_2	0.15	0.15	0.17	0.34	0.17	0.21
LOI	-	0.62	-	-	-	0.54

ILM Prospect - Continued

Element	6-25	6-26			
	Concentration, Parts Per Million				
Ag	<0.5	<0.5			
As	4.7	5			
Au	0.05	0.03			
B	20	<10			
Ba	150	180			
Be	10	10			
Bi	1.0	1.0			
Br	<1	2			
Cd	<0.2	<0.2			
Co	1	<1			
Cr	20	20			
Cs	1.3	1.0			
Cu	4.0	2.0			
Ga	-	-			
Ge	10	20			
Hf	1200	370			
Li	10	<10			
Mo	<5	<5			
Ni	2	2			
Pb	96	94			
Pd	-	-			
Pt	-	-			
Rb	250	450			
Sb	1.3	2.0			
Sc	0.31	0.4			
Se	<5	<3			
Sn	-	-			
Sr	<20	80			
Ta	21	37			
Te	-	-			
V	<10	<10			
W	<3	<3			
Zn	330	360			
	Concentration, Percent				
Al_2O_3	3.63	8.0			
CaO	0.06	0.19			
Fe_2O_3	8.69	4.28			
K_2O	3.12	4.20			
MgO	0.21	0.07			
MnO	0.18	0.14			
Na_2O	1.09	2.29			
P_2O_5	0.05	0.05			
SiO_2	72.6	76.4			
TiO_2	0.59	0.34			
LOI	1.84	1.54			

Little Jim

Element	7-1	7-2	7-3	7-4		
		Concentration, Parts Per Million				
Ag	<0.3	<0.3	<0.3	<0.3		
As	<600	<200	<200	<600		
Au	<0.007	<0.007	<0.007	<0.007		
B	100	100	200	90		
Ba	50	30	100	<20		
Be	2	5	7	7		
Bi	<100	<100	<100	<100		
Br	-	-	-	-		
Cd	<5	<5	<5	<5		
Co	<10	<10	<10	<10		
Cr	50	30	50	30		
Cs	-	-	-	-		
Cu	<6	<6	<6	<6		
Ga	<2	<20	<10	<2		
Ge	-	-	-	-		
Hf	-	-	-	-		
Li	<20	<20	<20	<20		
Mo	<1	<1	<1	<1		
Ni	8	20	10	<6		
Pb	<20	<20	<70	<20		
Pd	<1	<1	<1	<1		
Pt	<6	<6	<6	<6		
Rb	-	-	-	-		
Sb	<600	<600	<600	<600		
Sc	<4	<4	<4	<4		
Se	-	-	-	-		
Sn	<5	<5	<5	<5		
Sr	<1	<1	<1	<1		
Ta	<80	<80	<80	<80		
Te	<400	<400	<400	<400		
V	<50	<50	<50	<50		
W	-	-	-	-		
Zn	80	100	200	70		
		Concentration, Percent				
Al_2O_3	1.9	>9.5	>9.5	>7.6		
CaO	<0.07	<0.07	<0.07	<0.07		
Fe_2O_3	2.8	5.6	7.0	2.8		
K_2O	>12	>12	>12	>12		
MgO	0.0003	0.005	<0.003	0.003		
MnO	0.10	0.08	0.26	0.04		
Na_2O	0.5	7.8	5.0	2.6		
P_2O_5	<1.6	<1.6	<1.6	<1.6		
SiO_2	>21	>21	>21	>21		
TiO_2	<0.05	<0.07	<10	<0.05		
LOI	-	-	-	-		

Little Joe

Element	8-1	8-2	8-3	8-4	8-5
	Concentration, Parts Per Million				
Ag	<0.3	0.69	0.49	0.70	6.70
As	<100	<800	<90	<600	<600
Au	<0.007	<0.007	<0.007	<0.007	0.038
B	90	100	100	<80	<60
Ba	200	100	300	30	20
Be	29	9	13	2	7
Bi	<200	<100	<100	<100	<100
Br	-	-	-	-	-
Cd	<5	<5	<5	<5	<5
Co	<10	<10	<10	<10	<10
Cr	20	40	40	10	10
Cs	-	-	-	-	-
Cu	<6	<6	50	8	<6
Ga	<2	30	<3	<2	<2
Ge	-	-	-	-	-
Hf	1400	-	410	-	890
Li	<20	<20	<20	<20	<20
Mo	<1	<1	<1	<1	<1
Ni	<7	10	<4	<5	<6
Pb	<40	<20	<50	<20	<20
Pd	<1	<1	<1	<1	<1
Pt	<300	<6	<6	<6	<100
Rb	-	-	-	-	-
Sb	<600	<600	<600	<600	<600
Sc	-	-	-	-	-
Se	-	-	-	-	-
Sn	77	6	6	<5	81
Sr	90	<1	<1	<1	80
Ta	<80	<80	100	<80	<80
Te	<400	<400	<400	<400	<400
V	<50	<50	<50	<50	<50
W	-	-	-	-	-
Zn	500	70	200	50	100
	Concentration, Percent				
Al_2O_3	1.0	>9.5	>7.6	1.0	>5.7
CaO	2.8	<0.07	<0.07	<0.07	0.7
Fe_2O_3	8.4	8.4	5.6	1.4	9.8
K_2O	10.8	>12	>12	12	12
MgO	0.002	0.003	0.03	0.006	<0.0003
MnO	0.9	0.12	0.26	0.12	0.65
Na_2O	<1.3	7.8	2.6	<0.4	<0.4
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6
SiO_2	>21	>21	>21	>21	>21
TiO_2	1.7	0.5	0.5	<0.05	3.4
LOI	-	-	-	-	-

Irene-D Prospect

Element	9-1	9-2	9-3	9-4	9-5	9-7
Concentration, Parts Per Million						
Ag	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
As	<2	2	<2	<2	<2	<2
Au	0.29	0.6	0.540	<10	0.037	0.008
B	10	20	30	20	20	30
Ba	220	210	100	110	130	140
Be	<10	20	7	20	10	23
Bi	1.0	1.0	1.1	1.0	0.9	1.8
Br	1	1	1	1	1	<1
Cd	<0.2	<0.2	<1.0	<1.0	<1.0	1.0
Co	2	2	1	1	1	<1
Cr	210	370	20	<10	20	30
Cs	<0.6	0.8	1.2	<0.8	<0.7	1.5
Cu	2.5	33	0.5	2.5	3.0	5.0
Ga	-	-	-	-	-	-
Ge	<10	10	<10	20	10	<10
Hf	35	470	100	200	150	60
Li	10	<10	6	<10	6	6
Mo	<5	<5	<5	<5	<5	<5
Ni	6	8	3	2	2	5
Pb	30	60	16	66	40	18
Pd	-	-	-	-	-	-
Pt	-	-	-	-	-	-
Rb	320	300	180	160	180	130
Sb	<0.2	0.6	0.2	<0.2	<0.2	<0.2
Sc	0.6	0.2	1.05	0.4	0.30	0.15
Se	I	57	<10	<6	<5	<3
Sn	-	-	-	-	-	-
Sr	<20	<20	<10	<10	<10	<10
Ta	6	11	20	8	7	3
Te	-	-	-	-	-	-
V	<10	<10	<2	10	6	6
W	<3	4	3	3	4	3
Zn	110	66	81	77	93	83
Concentration, Percent						
Al_2O_3	10.2	6.60	8.87	5.44	7.25	3.23
CaO	0.05	0.02	0.02	0.03	0.07	0.04
Fe_2O_3	6.41	3.73	5.08	6.21	7.17	4.70
K_2O	5.67	5.45	3.87	3.86	4.01	2.72
MgO	0.11	0.09	<0.01	0.01	<0.01	<0.01
MnO	0.04	0.12	0.03	0.06	0.06	0.07
Na_2O	2.40	0.40	3.08	0.94	1.91	0.13
P_2O_5	0.03	0.05	0.01	0.06	0.05	0.04
SiO_2	73.4	79.3	77.3	81.0	77.6	86.4
TiO_2	0.21	0.19	0.23	0.24	0.30	0.20
LOI	0.54	0.47	0.54	0.46	0.46	0.46

Irene-D Prospect - Continued

Element	9-8	9-9	9-10	9-11	9-12	9-13
	Concentration, Parts Per Million					
Ag	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
As	<2	<2	3	<2	I	<2
Au	0.005	0.005	0.30	0.260	0.020	0.013
B	20	30	20	20	20	20
Ba	130	130	80	110	110	110
Be	9	17	11	9	10	13
Bi	1.3	1.3	0.5	1.0	0.8	0.7
Br	1	1	1	1	<1	<1
Cd	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Co	2	1	1	1	1	<1
Cr	20	20	<10	<10	20	20
Cs	0.9	<0.7	1.1	<1.2	<1.2	<0.9
Cu	<0.5	5.0	13	8.0	<0.5	2.5
Ga	-	-	-	-	-	-
Ge	<10	10	<10	10	10	<10
Hf	5	37	220	180	250	88
Li	6	6	<10	<10	20	4
Mo	<5	<5	<5	<5	<20	<5
Ni	3	5	3	4	<1	<1
Pb	20	20	34	56	16	16
Pd	-	-	-	-	-	-
Pt	-	-	-	-	-	-
Rb	250	240	210	210	360	170
Sb	0.3	<0.2	<0.2	0.2	1.2	0.2
Sc	3.63	0.05	0.5	0.6	1.44	0.64
Se	<3	7	<10	17	I	<5
Sn	-	-	-	-	-	-
Sr	<10	<10	<10	<10	<10	<10
Ta	<1	10	12	26	230	8
Te	-	-	-	-	-	-
V	4	6	8	10	<2	<2
W	<3	4	<3	5	I	<3
Zn	65	76	160	130	120	190
	Concentration, Percent					
Al_2O_3	8.09	8.38	6.66	7.96	8.95	9.85
CaO	0.01	0.11	0.05	0.08	0.04	0.01
Fe_2O_3	6.70	5.36	4.17	7.95	5.55	6.08
K_2O	5.37	5.36	4.55	4.80	3.91	3.69
MgO	<0.01	<0.01	0.05	0.09	<0.01	<0.01
MnO	0.06	0.05	0.08	0.11	0.03	0.03
Na_2O	1.44	1.36	1.12	1.72	4.97	3.75
P_2O_5	0.02	0.04	0.08	0.08	0.01	0.01
SiO_2	77.1	77.8	78.9	74.5	75.6	75.5
TiO_2	0.24	0.22	0.33	0.40	0.15	0.19
LOI	0.23	0.54	0.31	0.15	<0.01	0.69

Irene-D Prospect - Continued

Element	9-14	9-15	9-16	9-17	9-18	9-19
Concentration, Parts Per Million						
Ag	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
As	<2	<2	<2	<2	<2	<2
Au	0.005	0.008	0.005	0.045	0.035	0.005
B	20	20	20	30	20	30
Ba	100	100	110	90	110	160
Be	8	15	7	7	6	16
Bi	0.5	0.5	0.7	0.8	0.6	2.3
Br	1	1	1	<1	1	2
Cd	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Co	1	2	1	<1	<1	2
Cr	20	20	20	50	20	20
Cs	<1.0	<0.7	<0.7	<0.8	<0.8	0.7
Cu	0.5	3.0	1.0	<0.5	<0.5	1.0
Ga	-	-	-	-	-	-
Ge	<10	10	10	<10	<10	10
Hf	43	120	62	110	280	80
Li	5	38	98	6	4	32
Mo	<5	<5	<5	<5	<5	<5
Ni	1	2	<1	1	<1	<1
Pb	18	12	10	12	12	90
Pd	-	-	-	-	-	-
Pt	-	-	-	-	-	-
Rb	130	200	210	280	170	280
Sb	<0.2	<0.2	<0.2	0.3	<0.2	<0.2
Sc	0.07	0.09	<0.12	0.19	0.16	0.06
Se	<5	<5	<4	27	19	<5
Sn	-	-	-	-	-	-
Sr	<10	<10	<10	<10	<10	<10
Ta	8	6	6	10	4	7
Te	-	-	-	-	-	-
V	4	<2	2	<2	<2	4
W	<3	<3	<3	3	3	3
Zn	52	140	180	140	50	170
Concentration, Percent						
Al_2O_3	8.73	8.77	9.27	7.97	9.12	9.63
CaO	0.01	0.03	0.05	0.08	0.01	0.08
Fe_2O_3	5.82	6.66	5.88	7.39	5.06	4.56
K_2O	3.31	3.72	3.90	3.73	3.35	4.53
MgO	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
MnO	0.03	0.06	0.05	0.06	0.02	0.07
Na_2O	3.39	3.45	3.98	5.42	3.74	4.23
P_2O_5	0.02	0.02	0.02	0.02	0.01	0.05
SiO_2	77.7	76.0	76.0	75.5	77.5	75.5
TiO_2	0.19	0.20	0.18	0.25	0.16	0.31
LOI	0.62	0.46	0.46	<0.61	0.23	0.08

Irene-D Prospect - Continued

Element	9-20	9-21	9-22	9-23	9-24	9-25
			Concentration, Parts Per Million			
Ag	<0.5	<0.5	<0.5	<30	<10	<0.5
As	<2	<2	<2	300	<200	<2
Au	0.005	0.035	0.014	<20	<20	0.038
B	30	30	20	100	100	20
Ba	180	210	210	100	100	150
Be	14	14	110	1800	260	6
Bi	0.7	0.5	-	<400	<200	-
Br	1	1	1	-	-	2
Cd	<1.0	<1.0	<1.0	<5	<5	<1.0
Co	1	<1	7	<10	<10	1
Cr	20	50	20	10	<3	20
Cs	1.2	<0.9	<1.6	-	-	1.0
Cu	15	6.0	4.0	<6	<6	2.0
Ga	-	-	-	<2	<2	-
Ge	20	50	20	-	-	20
Hf	180	99	21	-	-	800
Li	4	24	-	<20	<20	-
Mo	<5	<5	<5	<1	<1	<5
Ni	2	17	12	10	10	5
Pb	100	220	12	<30	100	20
Pd	-	-	-	<1	<1	-
Pt	-	-	-	<6	<6	-
Rb	270	60	20	-	-	140
Sb	<0.2	0.2	<0.2	<600	<600	0.2
Sc	0.19	0.14	6.2	<4	<4	0.5
Se	<4	<5	<5	-	-	<5
Sn	-	-	-	<5	10.7	-
Sr	<10	30	160	30	<1	<10
Ta	4	11	<2	<100	<100	5
Te	-	-	-	<1000	<900	-
V	8	28	30	<50	<50	12
W	9	7	3	-	-	<6
Zn	220	170	56	40	40	180
			Concentration, Percent			
Al_2O_3	7.25	3.12	11.8	>7.6	>7.6	7.32
CaO	0.04	0.24	4.78	7.0	<0.07	0.03
Fe_2O_3	8.09	2.84	2.30	4.2	5.6	4.79
K_2O	4.49	0.17	0.28	3.6	6.0	2.32
MgO	<0.01	0.14	0.96	1.3	0.8	0.03
MnO	0.11	0.13	0.19	0.8	0.9	0.14
Na_2O	1.51	1.81	6.63	9.1	9.1	4.22
P_2O_5	0.04	0.02	0.04	<1.6	<1.6	0.05
SiO_2	75.5	86.2	69.1	>21	>21	74.5
TiO_2	0.60	0.21	0.22	<0.08	0.34	0.19
LOI	1.23	1.39	3.77	-	-	1.38

Element	10-1	10-2	10-3	10-4	10-5	10-6
			Concentration, Parts Per Million			
Ag	<0.5	<0.5	<0.5	0.5	<0.5	<0.5
As	I	10	8.0	4	20	I
Au	I	<0.01	0.02	I	0.05	0.04
B	30	30	20	20	30	20
Ba	140	410	250	220	400	320
Be	90	20	40	240	80	60
Bi	0.5	<0.5	1	0.5	0.5	<0.5
Br	1	1	<1	<2	I	I
Cd	<0.2	0.8	<0.2	2.2	<0.2	0.4
Co	1	11	14	12	<3	2
Cr	30	40	30	90	30	40
Cs	1.1	1.1	1.8	3.3	<0.5	<0.5
Cu	40	30	16	42	4	4.5
Ga	-	-	-	-	-	-
Ge	20	10	10	40	30	30
Hf	410	110	190	170	460	190
Li	<10	10	30	20	<10	20
Mo	<5	<5	<5	<5	<5	<5
Ni	12	9	12	38	9	7
Pb	400	150	300	180	460	240
Pd	-	-	-	-	-	-
Pt	-	-	-	-	-	-
Rb	20	130	130	330	110	130
Sb	2.6	2.8	2.0	1.7	4.5	1.7
Sc	0.21	17.1	7.79	6.6	0.5	2.7
Se	40	<3	<10	<100	<50	<10
Sn	-	-	-	-	-	-
Sr	40	40	140	30	20	60
Ta	69	20	32	80	57	27
Te	-	-	-	-	-	-
V	20	160	100	100	20	30
W	<3	<3	<3	I	<6	I
Zn	670	430	530	1800	1200	450
			Concentration, Percent			
Al_2O_3	6.03	15.2	11.0	9.03	6.75	10.8
CaO	<0.07	0.18	0.22	2.20	0.12	0.22
Fe_2O_3	6.02	6.87	8.84	5.61	5.38	3.85
K_2O	0.07	2.59	0.91	0.92	1.63	1.46
MgO	0.17	1.34	1.03	2.85	0.12	0.43
MnO	0.11	0.21	0.31	0.26	0.31	0.09
Na_2O	3.80	3.96	5.55	3.82	3.50	4.81
P_2O_5	0.07	0.09	0.15	0.12	0.07	0.05
SiO_2	78.1	65.3	67.1	68.2	77.0	75.2
TiO_2	0.68	0.70	1.07	0.64	0.67	0.46
LOI	0.92	2.70	2.16	3.93	0.70	1.16

Geiger - Continued

Element	10-7	10-8	10-9	10-10	10-11	10-12
Concentration, Parts Per Million						
Ag	<0.5	<0.5	0.5	<0.3	1.5	<0.5
As	4	8	<90	<200	75	45
Au	0.01	0.04	<0.007	<0.007	0.40	0.06
B	20	30	<60	100	10	20
Ba	110	290	100	300	270	160
Be	20	90	70	90	60	10
Bi	<0.5	0.5	<100	<100	<0.5	<0.5
Br	<1	<1	-	-	<1	<2
Cd	1.0	0.6	<5	<5	1	2
Co	2	1	<10	<10	4	1
Cr	30	20	10	10	30	20
Cs	0.6	1.1	-	-	1.7	<0.8
Cu	24	6	<6	<6	7	4
Ga	-	-	<2	<2	-	-
Ge	30	20	-	-	40	10
Hf	460	220	-	-	360	350
Li	<10	<10	<20	<5000	40	<10
Mo	<5	<5	<1	<1	<5	<5
Ni	6	6	10	10	3	2
Pb	44	310	300	<50	640	200
Pd	-	-	<1	<1	-	-
Pt	-	-	<6	<6	-	-
Rb	30	50	-	-	210	100
Sb	1.3	1.3	<600	<700	6.7	4.1
Sc	1.0	4.3	<4	<4	1	0.57
Se	<50	<50	-	-	22	31
Sn	-	-	31	<5	-	-
Sr	<20	40	1	20	30	30
Ta	74	39	<80	<80	240	100
Te	-	-	<400	<400	-	-
V	20	10	<50	<50	10	10
W	<3	<3	-	-	I	7
Zn	560	1300	3000	2000	2600	3300
Concentration, Percent						
Al_2O_3	6.18	10.0	>5.7	>9.5	5.82	4.44
CaO	0.30	1.25	<0.09	4.2	0.06	0.04
Fe_2O_3	4.25	3.72	5.6	5.6	4.26	3.57
K_2O	0.14	0.61	>12	>12	1.40	0.76
MgO	0.09	0.77	0.02	4.8	0.14	0.14
MnO	0.14	0.16	0.1	>2.6	0.15	0.10
Na_2O	4.01	5.57	5.2	13	3.07	2.80
P_2O_5	0.04	0.06	<1.6	<1.6	0.03	0.02
SiO_2	80.3	73.5	>21	>21	79.9	82.3
TiO_2	0.57	0.48	0.2	0.3	0.43	0.46
LOI	0.85	1.93	-	-	2.16	2.31

Geiger - Continued

Element	10-13	10-14	10-15	10-16	10-17	10-18
			Concentration, Parts Per Million			
Ag	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
As	15	8	4	<4	2	2
Au	0.02	<0.01	<0.01	<0.04	0.20	<0.01
B	<10	10	10	30	30	30
Ba	230	300	390	160	120	140
Be	40	30	20	40	40	70
Bi	1.5	<0.5	0.5	<0.5	0.5	<0.5
Br	1	2	4	<1	3	3
Cd	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Co	1	9	19	5	1	3
Cr	20	10	20	30	30	20
Cs	1.2	4.2	2.1	10.4	1.1	1.5
Cu	3.5	4.0	16	4.5	4.0	4.5
Ga	-	-	-	-	-	-
Ge	20	10	10	40	30	30
Hf	350	5	4	260	280	25
Li	220	600	350	300	340	850
Mo	<5	<5	<5	<5	<5	<5
Ni	1	1	7	6	3	4
Pb	290	20	14	84	100	36
Pd	-	-	-	-	-	-
Pt	-	-	-	-	-	-
Rb	140	410	190	400	310	400
Sb	3.2	1.2	0.9	2.7	2.4	3.1
Sc	1.3	10.5	10.1	3.8	2.2	7.6
Se	14	<3	<3	<50	<3	12
Sn	-	-	-	-	-	-
Sr	<20	40	50	<20	<20	30
Ta	100	1	2	84	84	110
Te	-	-	-	-	-	-
V	10	50	60	20	10	40
W	I	4	<3	I	I	6
Zn	190	50	72	300	230	280
			Concentration, Percent			
Al_2O_3	4.19	13.6	11.6	6.74	5.35	9.21
CaO	0.09	0.90	1.07	0.19	0.08	0.20
Fe_2O_3	4.04	6.22	7.33	4.49	4.59	5.57
K_2O	0.74	1.49	1.18	1.73	1.35	1.54
MgO	0.58	3.44	2.98	1.57	0.82	2.41
MnO	0.20	0.09	0.12	0.13	0.15	0.15
Na_2O	3.40	7.75	6.73	4.88	4.51	6.91
P_2O_5	0.03	0.16	0.12	0.09	0.06	0.11
SiO_2	82.5	63.4	64.5	75.3	79.2	71.7
TiO_2	0.64	0.55	0.54	0.71	0.57	0.51
LOI	1.08	2.47	4.00	1.54	0.77	0.93

Element	10-19	10-20	10-21	10-22	10-23	10-24
	Concentration, Parts Per Million					
Ag	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
As	I	I	3.3	<0.79	I	1.9
Au	I	<0.01	<0.01	<0.01	0.04	<0.01
B	20	20	10	40	30	30
Ba	140	730	640	I	140	140
Be	20	40	20	70	50	30
Bi	0.5	<0.5	<0.5	<0.5	0.5	<0.5
Br	<1	1	17	2	<1	1
Cd	<0.2	<0.2	<0.2	<0.2	<0.2	1.0
Co	1	31	27	6	1	1
Cr	40	270	20	I	20	20
Cs	<1.0	37.5	30.5	1.5	<1.0	0.7
Cu	6.0	14	39	4.0	2.0	1.5
Ga	-	-	-	-	-	-
Ge	20	<10	<10	<10	20	20
Hf	440	6	4	12	430	30
Li	80	520	270	720	<10	<10
Mo	<5	14	<5	<5	<5	<5
Ni	5	61	9	8	5	2
Pb	140	28	20	220	170	170
Pd	-	-	-	-	-	-
Pt	-	-	-	-	-	-
Rb	80	2600	2000	I	380	520
Sb	1.9	1.9	1.0	1.0	0.8	1.8
Sc	1.58	27.6	17.9	4.87	0.39	0.49
Se	<10	<3	<3	16	<50	28
Sn	-	-	-	-	-	-
Sr	<20	<20	20	I	<20	<20
Ta	94	1	<1	48	72	180
Te	-	-	-	-	-	-
V	20	260	260	40	10	<10
W	I	I	<3	3	3	4
Zn	480	240	230	1000	330	310
	Concentration, Percent					
Al_2O_3	5.18	14.2	17.2	I	4.90	9.32
CaO	0.06	0.36	0.25	I	0.03	0.08
Fe_2O_3	4.44	11.0	10.6	I	5.41	1.42
K_2O	0.34	5.60	4.31	I	2.08	2.59
MgO	0.28	10.2	5.81	I	0.18	<0.01
MnO	0.12	0.23	0.11	I	0.19	0.03
Na_2O	3.63	4.18	5.35	I	2.57	4.69
P_2O_5	0.03	0.11	0.15	I	0.05	0.02
SiO_2	80.5	48.9	50.2	I	78.4	79.7
TiO_2	0.66	0.79	1.06	I	0.79	0.12
LOI	1.47	2.85	3.47	I	1.54	0.70

Geiger - Continued

Element	10-25	10-26	10-27	10-28	10-29	10-30
	Concentration, Parts Per Million					
Ag	<0.5	<0.5	<0.5	<0.5	2.5	<0.5
As	<2	<4	12	0.75	5.2	1.5
Au	<0.01	<0.01	<0.01	0.030	0.040	<0.01
B	40	20	<10	30	20	30
Ba	300	100	160	110	120	130
Be	70	30	10	40	20	30
Bi	<0.5	1.0	<0.5	1.0	4.0	2.5
Br	3	<1	1	1	1	1
Cd	<0.5	<0.2	<0.2	1.0	6.0	4.8
Co	2	3	8	<1	<1	3
Cr	20	30	60	30	30	20
Cs	1.7	<4.0	<0.8	<1.0	<0.9	1.1
Cu	4.5	2.5	5.5	2	100	130
Ga	-	-	-	-	-	-
Ge	10	30	<10	10	<10	20
Hf	48	530	3	460	470	250
Li	280	<10	10	<10	50	260
Mo	<5	<5	<5	<5	<5	<5
Ni	6	4	7	13	3	4
Pb	310	120	120	48	420	960
Pd	-	-	-	-	-	-
Pt	-	-	-	-	-	-
Rb	800	300	320	320	30	120
Sb	1.3	1.1	1.3	1.4	1.7	1.9
Sc	1.3	0.3	1.49	0.14	0.56	3.20
Se	20	<50	28	<50	49	25
Sn	-	-	-	-	-	-
Sr	<20	<20	<20	<20	<20	<20
Ta	81	66	590	27	42	42
Te	-	-	-	-	-	-
V	20	10	20	<10	10	10
W	<3	I	I	<3	<3	<3
Zn	620	130	350	230	1500	1400
	Concentration, Percent					
Al_2O_3	9.51	5.35	5.46	5.75	5.83	9.02
CaO	0.09	0.06	0.14	0.06	0.05	0.48
Fe_2O_3	2.41	4.86	4.75	6.63	5.64	4.02
K_2O	3.66	1.61	1.86	1.66	0.14	0.47
MgO	0.80	0.08	0.90	0.14	0.27	0.82
MnO	0.33	0.14	0.24	0.15	0.12	0.17
Na_2O	4.69	4.74	4.63	5.07	3.65	5.82
P_2O_5	0.02	0.04	0.14	0.04	0.04	0.03
SiO_2	76.8	77.5	77.7	74.8	77.1	74.4
TiO_2	0.23	0.75	0.70	0.83	0.91	0.56
LOI	1.08	0.85	0.92	0.46	2.61	2.31

Geiger - Continued

Element	10-31	10-32				
	Concentration, Parts Per Million					
Ag	<0.5	<0.5				
As	<0.63	I				
Au	<0.01	0.21				
B	20	20				
Ba	140	130				
Be	30	20				
Bi	<0.5	0.5				
Br	2	1				
Cd	<0.2	<0.2				
Co	4	<1				
Cr	20	30				
Cs	<1.1	0.9				
Cu	9.0	3.0				
Ga	-	-				
Ge	<10	20				
Hf	19	490				
Li	340	60				
Mo	<5	<5				
Ni	4	9				
Pb	72	60				
Pd	-	-				
Pt	-	-				
Rb	130	470				
Sb	0.8	0.8				
Sc	7.44	0.78				
Se	<3	I				
Sn	-	-				
Sr	30	<20				
Ta	19	46				
Te	-	-				
V	20	10				
W	<3	I				
Zn	190	180				
	Concentration, Percent					
Al_2O_3	11.1	6.00				
CaO	0.38	0.09				
Fe_2O_3	3.58	4.97				
K_2O	0.73	2.48				
MgO	1.57	0.41				
MnO	0.12	0.15				
Na_2O	8.05	3.65				
P_2O_5	0.06	0.06				
SiO_2	72.4	72.2				
TiO_2	0.40	0.75				
LOI	0.93	5.69				

I and L

Element	11-1	11-2	11-3	11-4	11-5	11-6
			Concentration, Parts Per Million			
Ag	<40	60	60	<60	<60	1000
As	<200	300	<200	<200	<200	700
Au	<20	<30	<20	<20	<20	0.6
B	90	100	<80	90	80	900
Ba	20	90	90	30	10	700
Be	-	13	480	-	-	14
Bi	<30	<600	<300	<10	<10	1000
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<10	<10	<10	<10	<10	20
Cr	10	20	20	70	70	40
Cs	-	-	-	-	-	-
Cu	<6	<6	<6	<6	<6	20
Ga	<20	<20	<8	<10	<8	90
Ge	-	-	-	-	-	-
Hf	-	-	-	-	-	I
Li	<20	<20	<20	<900	<20	<20
Mo	<1	<1	<1	<1	<1	<1
Ni	20	30	40	20	50	200
Pb	<80	300	900	300	1000	5000
Pd	<1	<1	<1	<1	<1	0.014
Pt	<6	<6	<6	<6	<10	<0.01
Rb	-	-	-	-	-	-
Sb	1000	<600	<600	<600	<600	<600
Sc	<4	<4	<4	<4	<4	<4
Se	-	-	-	-	-	-
Sn	9.6	7.6	7.6	11.3	25.4	300
Sr	<1	2	10	6	10	30
Ta	<100	<100	<100	<100	<100	<100
Te	1000	<800	<500	<800	<700	<700
V	<50	<50	<50	<50	<50	200
W	-	-	-	-	-	-
Zn	200	300	600	200	500	600
			Concentration, Percent			
Al_2O_3	>9.5	>9.5	>7.6	>9.5	>9.5	0.76
CaO	<0.07	1.2	4.2	0.42	<0.14	<1.3
Fe_2O_3	7.0	5.2	5.2	5.2	7.0	9.8
K_2O	>12	6.0	3.6	>12	>12	10.8
MgO	0.005	0.16	0.14	0.48	0.013	0.003
MnO	0.13	0.39	1.04	0.13	>2.6	>2.6
Na_2O	13.0	11.7	7.8	13	10.4	2.6
P_2O_5	<2.3	<1.6	<1.6	<1.8	<1.6	<1.6
SiO_2	>21	>21	>21	>21	>21	>21
TiO_2	<0.11	<0.07	0.14	0.14	<0.17	0.68
LOI	-	-	-	-	-	-

I and L - Continued

Element	11-7	11-8	11-9	11-10	11-11	11-12
	Concentration, Parts Per Million					
Ag	90	<10	<60	<70	<60	<60
As	500	<200	300	500	400	<200
Au	<40	<20	<30	<40	<30	<20
B	100	100	100	100	100	90
Ba	80	300	300	50	20	300
Be	20	8	-	-	-	9
Bi	<700	<500	<700	<100	<100	<100
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<10	<10	<10	<10	<10	<10
Cr	40	60	200	200	100	70
Cs	-	-	-	-	-	-
Cu	<6	<6	<6	<6	<6	<6
Ga	30	<5	30	20	20	<10
Ge	-	-	-	-	-	-
Hf	-	-	-	-	-	-
Li	<20	<20	<50	<20	<20	>900
Mo	<1	<1	<1	<1	<1	<1
Ni	20	10	20	30	20	20
Pb	200	<40	500	600	200	300
Pd	<1	<1	<1	<1	<4	<1
Pt	<6	<6	<6	<10	<6	<6
Rb	-	-	-	-	-	-
Sb	<600	<600	<600	<600	<600	<600
Sc	<4	<4	<4	<4	<4	<4
Se	-	-	-	-	-	-
Sn	29.9	<5.0	13.7	48	25.4	42
Sr	<1	3	2	<1	<1	6
Ta	<100	<100	<100	<100	<100	<100
Te	<900	<400	<1000	1000	1000	<800
V	<50	<50	<50	<50	<50	<50
W	-	-	-	-	-	-
Zn	500	500	200	200	200	200
	Concentration, Percent					
Al_2O_3	>7.6	>7.6	>13.3	>11.4	>11.4	>9.5
CaO	<0.07	0.42	0.52	<0.07	<0.07	0.42
Fe_2O_3	4.2	4.2	5.2	5.2	7.0	5.2
K_2O	4.8	12.0	>12	10.8	12	>12
MgO	0.014	0.32	0.16	0.005	0.032	0.50
MnO	0.14	0.13	0.13	0.13	0.091	0.13
Na_2O	-	7.8	13.0	10.4	13	13
P_2O_5	<1.6	<1.6	<2.3	<2.3	<2.3	<1.6
SiO_2	>21	>21	>21	>21	>21	>21
TiO_2	<0.13	<0.07	0.34	0.51	<0.11	0.14
LOI	-	-	-	-	-	-

I and L - Continued

Element	11-13	11-14	11-15	11-16	11-17	11-18
Concentration, Parts Per Million						
Ag	<10	<20	<50	300	60	<50
As	<100	<90	300	500	400	400
Au	<20	<30	<30	0.2	<30	<30
B	100	<80	100	100	100	100
Ba	<20	60	60	200	60	60
Be	14	21	20	82	2000	13
Bi	<200	<200	<300	<700	<300	<500
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<10	<10	<10	<10	<10	<10
Cr	200	70	60	50	50	100
Cs	-	-	-	-	-	-
Cu	<6	<6	<6	<6	<6	<6
Ga	<6	<3	<10	50	20	40
Ge	-	-	-	-	-	-
Hf	-	-	-	340	-	-
Li	<20	<20	100	<20	100	<30
Mo	<1	<1	<1	<1	<1	<1
Ni	10	<8	30	70	30	20
Pb	<50	3000	400	5000	200	900
Pd	<1	<1	<1	<1	<1	<1
Pt	<6	<6	<6	<6	<6	<6
Rb	-	-	-	-	-	-
Sb	<600	<600	<600	<1000	<600	<600
Sc	<4	<4	<4	<4	<4	<4
Se	-	-	-	-	-	-
Sn	52	220	120	380	210	7
Sr	<1	5	1	5	<1	1
Ta	<100	200	<100	400	<100	<100
Te	<800	<900	<1000	<1000	1000	<1000
V	<50	<50	<50	200	<50	<50
W	-	-	-	-	-	-
Zn	200	900	200	70	100	50
Concentration, Percent						
Al_2O_3	>5.7	>3.8	>7.6	>7.6	>7.6	>13.3
CaO	<0.07	0.42	<0.07	<0.91	<0.08	<0.14
Fe_2O_3	9.8	11.2	8.4	14.0	7.0	5.6
K_2O	<0.96	<1.2	3.6	4.8	3.6	12
MgO	0.003	0.16	0.16	0.05	0.16	0.02
MnO	0.65	0.52	-	-	-	0.26
Na_2O	5.2	<0.91	6.5	5.2	5.2	>13
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.8
SiO_2	>21	>21	>21	>21	>21	>21
TiO_2	0.15	0.34	0.17	0.85	0.34	0.34
LOI	-	-	-	-	-	-

Element	11-19	11-20	11-21	11-22	11-23	11-24
	Concentration, Parts Per Million					
Ag	<50	80	90	<10	90	80
As	400	300	500	<200	<300	<100
Au	<20	<30	<20	<40	0.05	<40
B	100	90	90	100	100	100
Ba	50	100	30	<20	100	50
Be	2000	460	2000	580	690	11
Bi	<200	<300	<400	<300	<500	<200
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<10	<10	<10	<10	<10	<10
Cr	50	40	30	100	50	100
Cs	-	-	-	-	-	-
Cu	<6	<6	<6	<6	<6	<6
Ga	<7	30	<6	<3	40	<6
Ge	-	-	-	-	-	-
Hf	-	-	-	-	64	-
Li	>600	200	<20	<20	200	<20
Mo	<1	<1	<1	<1	<1	<1
Ni	30	40	30	10	30	20
Pb	1000	2000	600	700	900	200
Pd	<1	<1	<1	<1	<1	<1
Pt	<6	<10	<6	<10	<20	<10
Rb	-	-	-	-	-	-
Sb	<600	<700	<600	<600	<600	<600
Sc	<4	<4	<4	<4	<4	<4
Se	-	-	-	-	-	-
Sn	46	120	28.3	61	35	9.2
Sr	<1	1	<1	2	4	<1
Ta	100	100	<100	300	<100	<100
Te	1000	<900	<600	<700	2000	2000
V	<50	<70	<50	<50	<80	<50
W	-	-	-	-	-	-
Zn	300	400	900	400	200	40
	Concentration, Percent					
Al_2O_3	>7.6	>9.5	>5.7	>5.7	>7.6	>5.7
CaO	<0.07	<0.07	<0.10	<0.07	<0.07	<0.07
Fe_2O_3	5.6	8.4	2.8	4.2	8.4	4.2
K_2O	11.7	5.2	7.2	<0.72	6.0	6.0
MgO	0.64	0.48	0.10	0.05	0.50	0.05
MnO	0.26	0.39	0.78	0.39	0.52	0.06
Na_2O	9.1	10.4	9.1	4.2	5.2	0.06
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.0
SiO_2	>21	>21	>21	>21	>21	>21
TiO_2	<0.07	0.17	0.07	<0.07	0.34	<0.07
LOI	-	-	-	-	-	-

I and L - Continued

Element	11-25	11-26	11-27	11-28	11-29	11-30
			Concentration, Parts Per Million			
Ag	<80	<50	<5	<5	<7	<7
As	<200	400	<90	<90	<90	<90
Au	<30	<30	<20	<20	<20	<20
B	100	100	<80	90	100	100
Ba	100	30	30	30	400	80
Be	130	17	310	50	8	12
Bi	<300	<400	<200	<100	<400	<500
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<10	<10	<10	<10	<10	<10
Cr	60	80	40	20	70	70
Cs	-	-	-	-	-	-
Cu	<6	<6	<6	<6	<6	<6
Ga	<9	20	<2	<5	<2	<10
Ge	-	-	-	-	-	-
Hf	-	-	-	-	-	-
Li	100	<20	<20	<20	<20	>300
Mo	<1	<1	<1	<1	<1	<1
Ni	20	20	9	<6	9	10
Pb	2000	300	100	100	<50	200
Pd	<1	<1	<1	<1	<1	<1
Pt	<10	<10	<6	<6	<6	<6
Rb	-	-	-	-	-	-
Sb	<600	<600	<600	<600	<600	<600
Sc	<4	<4	<4	<4	<4	4
Se	-	-	-	-	-	-
Sn	70	52	<5	-	<5	8.8
Sr	3	<1	<1	<1	3	1
Ta	<100	<100	<100	-	<100	<100
Te	2000	1000	<700	<400	<700	<800
V	<50	<50	<50	<50	<50	<50
W	-	-	-	-	-	-
Zn	400	90	900	700	90	300
			Concentration, Percent			
Al_2O_3	>5.7	>7.6	>7.6	>7.6	>7.6	>7.6
CaO	<0.13	<0.13	<0.07	<0.07	0.42	<0.07
Fe_2O_3	4.2	5.6	2.8	5.2	2.8	4.2
K_2O	6.0	4.8	<1.2	8.4	>12	8.4
MgO	0.32	0.02	0.48	0.32	0.11	0.16
MnO	0.65	0.42	0.65	0.13	0.10	0.26
Na_2O	3.9	6.5	5.6	13.0	6.5	10.4
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
SiO_2	>21	>21	>21	>21	>21	>21
TiO_2	<0.10	<0.07	<0.05	<0.05	<0.05	<0.05
LOI	-	-	-	-	-	-

I and L - Continued

Element	11-31	11-32	11-33	11-34	11-35	11-36
	Concentration, Parts Per Million					
Ag	<7	60	50	60	300	<10
As	<90	300	400	<200	<90	<90
Au	<20	<30	<40	<20	<20	<20
B	100	100	100	100	<40	100
Ba	<20	<20	30	<20	70	100
Be	16	16	87	380	1200	23
Bi	<200	<300	<400	<300	<200	<200
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<10	<10	<20	<10	<10	<10
Cr	100	90	60	50	<4	200
Cs	-	-	-	-	-	-
Cu	<6	<6	<6	<6	<6	<6
Ga	<6	<4	<10	20	<2	<2
Ge	-	-	-	-	-	-
Hf	-	-	-	-	-	-
Li	>500	<20	<20	<20	<20	>2000
Mo	<1	<1	<1	<1	<1	<1
Ni	10	20	20	30	300	10
Pb	200	90	300	100	2000	200
Pd	<1	<1	<1	<1	9	<1
Pt	<6	<6	<9	<7	<10	<6
Rb	-	-	-	-	-	-
Sb	<600	<600	<600	<600	<600	<600
Sc	<4	<4	<4	<4	<4	<4
Se	-	-	-	-	-	-
Sn	11.2	60	22.7	17.1	22.7	44
Sr	<1	3	2	<1	20	3
Ta	<100	200	<100	<100	<100	<100
Te	<700	1000	1000	1000	<400	<800
V	<50	<50	<50	<50	<50	<50
W	-	-	-	-	-	-
Zn	600	1000	200	100	2000	4000
	Concentration, Percent					
Al_2O_3	>7.6	1.9	>5.7	>7.6	>5.7	>5.7
CaO	0.14	<0.07	<0.07	<0.07	<0.72	0.28
Fe_2O_3	4.2	2.8	4.2	8.4	5.2	5.6
K_2O	<2.2	4.8	3.6	8.4	10.8	3.6
MgO	0.32	0.03	0.14	0.0005	0.03	0.80
MnO	0.26	0.13	0.12	0.26	>6.5	0.26
Na_2O	7.8	1.3	2.6	5.2	7.8	7.8
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
SiO_2	>21	>21	>21	>21	>21	>21
TiO_2	<0.05	<0.05	<0.05	0.17	<0.05	<0.05
LOI	-	-	-	-	-	-

Element	11-37	11-38	11-39	11-40	11-41	11-42
			Concentration, Parts Per Million			
Ag	<20	<40	<30	70	<20	80
As	<500	<200	300	<200	<90	600
Au	<20	<30	<30	0.050	<20	0.080
B	<80	100	100	100	90	200
Ba	<20	30	40	90	<20	100
Be	21	29	16	10	8	47
Bi	<200	<300	<200	<400	<200	<600
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<10	<10	<20	<10	<10	<10
Cr	70	70	80	70	100	70
Cs	-	-	-	-	-	-
Cu	<6	<6	<6	<6	<6	<6
Ga	<2	<3	20	20	<2	30
Ge	-	-	-	-	-	-
Hf	-	290	-	130	-	300
Li	100	<20	<20	<20	200	<20
Mo	<1	<1	<1	<1	<1	<1
Ni	9	10	20	30	10	20
Pb	<70	<50	500	100	100	200
Pd	<1	<1	<1	<1	<1	<1
Pt	<6	<6	<7	<6	<6	<10
Rb	-	-	-	-	-	-
Sb	<600	<600	<600	<600	<600	<600
Sc	<4	<4	<4	<4	<4	<4
Se	-	-	-	-	-	-
Sn	20.5	64	55	150	39	63
Sr	2	<1	20	3	1	20
Ta	100	200	100	<100	<100	<100
Te	1000	<900	<1000	2000	1000	<700
V	<50	<50	<50	<50	<50	<80
W	-	-	-	-	-	-
Zn	400	80	500	400	400	100
			Concentration, Percent			
Al_2O_3	1.9	1.5	>7.6	>7.6	1.71	>5.7
CaO	<0.07	<0.28	1.12	<0.28	<0.07	<0.07
Fe_2O_3	2.8	2.8	5.6	5.6	4.2	4.2
K_2O	<1.2	<1.2	<2.4	4.8	<0.72	<0.84
MgO	0.16	0.003	0.16	0.03	0.13	0.008
MnO	0.09	0.10	0.39	0.91	0.13	0.39
Na_2O	2.6	<1.04	7.8	6.5	<1.3	3.9
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
SiO_2	>21	>21	>21	>21	>21	>21
TiO_2	<0.05	<0.05	0.15	<0.12	<0.05	0.17
LOI	-	-	-	-	-	-

Element	11-43	11-44	11-45	11-46	11-47	11-48
	Concentration, Parts Per Million					
Ag	60	70	<40	<50	<40	60
As	<100	300	<300	<300	500	400
Au	<20	<40	-	<20	<40	0.050
B	<70	100	100	100	100	100
Ba	100	60	70	300	<20	50
Be	22	16	7	3	12	14
Bi	<200	<300	<300	<400	<300	<400
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<10	<10	<10	<10	<10	<10
Cr	30	100	30	50	200	90
Cs	-	-	-	-	-	-
Cu	<6	<6	<6	<6	<6	<6
Ga	<10	<10	<6	<10	<3	<6
Ge	-	-	-	-	-	-
Hf	61	-	-	-	-	130
Li	<20	<20	>3000	>2000	<20	<20
Mo	<1	<1	<1	<1	<1	<1
Ni	20	20	20	30	20	30
Pb	700	90	300	1000	<60	100
Pd	<1	<1	<4	<1	<1	<1
Pt	<8	<10	<6	<6	<9	<9
Rb	-	-	-	-	-	-
Sb	<600	<600	<600	<600	<600	<600
Sc	<4	<4	<4	<4	<4	4
Se	-	-	-	-	-	-
Sn	47	91	150	<5	25.1	180
Sr	200	5	1	4	<1	2
Ta	100	200	200	<100	240	280
Te	<700	1000	1000	1000	1000	1000
V	<60	<50	<50	<50	<50	<80
W	-	-	-	-	-	-
Zn	900	200	100	900	20	200
	Concentration, Percent					
Al_2O_3	1.3	>5.7	>9.5	>7.6	0.57	1.9
CaO	5.6	<0.07	0.42	0.28	<0.07	<0.12
Fe_2O_3	2.8	5.2	4.2	8.4	1.4	7.0
K_2O	<2.4	3.6	9.6	12	4.8	6.0
MgO	0.006	0.03	0.96	1.7	0.008	0.11
MnO	0.05	0.13	0.12	0.65	0.04	0.26
Na_2O	2.6	1.3	13.0	10.4	<0.39	<1.3
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
SiO_2	>21	>21	>21	>21	>21	>21
TiO_2	<0.10	0.34	<0.10	0.17	<0.05	0.17
LOI	-	-	-	-	-	-

Element	12-1	12-2	12-3	12-4	12-5	12-6
			Concentration, Parts Per Million			
Ag	<30	50	60	<30	<30	<40
As	<200	300	300	<200	<200	300
Au	<20	<20	<20	<20	<20	<20
B	100	100	100	100	100	100
Ba	40	200	50	100	200	800
Be	16	92	64	47	130	16
Bi	<200	<300	<400	<300	<200	<300
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<10	<10	<10	<10	<10	<10
Cr	50	60	<40	40	50	30
Cs	-	-	-	-	-	-
Cu	<6	<6	<6	<6	<6	<6
Ga	20	20	<10	20	<10	<7
Ge	-	-	-	-	-	-
Hf	-	-	-	-	-	-
Li	<20	<20	<20	<40	>1000	>1000
Mo	<1	<1	<1	<1	<1	<1
Ni	20	40	20	30	20	20
Pb	100	900	500	900	400	700
Pd	<1	<1	<1	<1	<1	<1
Pt	<6	<7	<6	<6	<9	<9
Rb	-	-	-	-	-	-
Sb	<600	<600	<600	<600	<60	<600
Sc	<4	<4	<4	<4	<4	4
Se	-	-	-	-	-	-
Sn	71	93	75	180	93	17.4
Sr	<1	5	<10	200	1	10
Ta	<100	<100	<100	<100	<100	<100
Te	1000	<1000	<1000	<800	<900	1000
V	<50	<50	<50	100	<50	<50
W	-	-	-	-	-	-
Zn	200	500	500	600	1000	400
			Concentration, Percent			
Al_2O_3	>7.6	>7.6	>7.6	>7.6	>7.6	>7.6
CaO	<0.7	2.8	<0.07	9.8	<0.08	1.4
Fe_2O_3	5.6	5.6	5.6	11.2	5.6	4.2
K_2O	3.6	>12	7.2	3.6	8.4	8.4
MgO	0.02	0.16	0.06	1.6	0.48	1.1
MnO	0.07	0.65	0.65	1.4	0.3	0.3
Na_2O	3.9	6.5	7.8	6.5	6.5	10.4
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
SiO_2	>21	>21	>21	>21	>21	>21
TiO_2	<0.10	0.17	0.14	0.34	0.17	<0.06
LOI	-	-	-	-	-	-

Dotson

Element	12-7	12-8	12-9	12-10	12-11	12-12
			Concentration, Parts Per Million			
Ag	70	<40	<40	<30	<20	<40
As	<30	<30	30	30	300	300
Au	<20	<20	<20	<20	<20	<20
B	100	200	100	200	100	100
Ba	500	300	800	200	200	500
Be	41	64	18	63	-	29
Bi	<400	<400	<300	<200	<300	<300
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<10	<10	<10	<10	<10	<10
Cr	60	60	80	50	60	70
Cs	-	-	-	-	-	-
Cu	<6	<6	<6	<6	<6	<6
Ga	30	<8	<6	<9	<20	<60
Ge	-	-	-	-	-	-
Hf	-	-	-	-	-	-
Li	<20	60	>700	>2000	<20	>800
Mo	<1	<1	<1	<1	<1	<1
Ni	30	20	20	20	20	20
Pb	80	90	200	200	300	200
Pd	<1	<1	<1	<1	<1	<1
Pt	<10	<6	<6	<6	<6	<6
Rb	-	-	-	-	-	-
Sb	<600	<600	<600	<600	<600	<600
Sc	<4	<4	<4	<4	<4	<4
Se	-	-	-	-	-	-
Sn	110	79	34	110	180	60
Sr	1	4	8	4	1	<60
Ta	<100	<100	<100	<100	<100	<100
Te	1000	1000	1000	<600	<1000	<90
V	<50	<50	<50	<50	<50	<50
W	-	-	-	-	-	-
Zn	100	500	400	1000	500	700
			Concentration, Percent			
Al_2O_3	>7.6	>7.6	>7.6	>7.6	>7.6	>7.6
CaO	<0.7	0.98	0.98	0.70	<0.07	0.7
Fe_2O_3	7.0	5.6	5.6	4.2	4.2	5.6
K_2O	>12	>12	>12	>12	>12	12
MgO	0.3	1.0	1.0	0.6	0.3	0.64
MnO	0.1	0.5	0.3	0.8	1.2	0.6
Na_2O	3.9	7.8	9.1	6.5	6.5	10.4
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
SiO_2	>21	>21	>21	>21	>21	>21
TiO_2	0.17	<0.10	<0.10	<0.07	0.17	0.17
LOI	-	-	-	-	-	-

Element	12-13	12-14	12-15	12-16	12-17	12-18
	Concentration, Parts Per Million					
Ag	80	60	50	60	70	80
As	<200	<300	400	<400	400	300
Au	<20	<20	<30	<30	<40	<20
B	100	100	100	100	200	100
Ba	200	100	200	200	200	700
Be	58	68	28	42	36	8
Bi	<200	<300	<500	<400	<500	<500
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<10	<10	<10	<10	<10	<10
Cr	30	50	60	50	60	20
Cs	-	-	-	-	-	-
Cu	<6	<6	<6	<6	<6	<6
Ga	30	30	20	30	40	20
Ge	-	-	-	-	-	-
Hf	220	-	-	-	-	-
Li	<200	<200	<200	<30	<40	>4000
Mo	<1	<1	<1	<1	<1	<1
Ni	40	20	20	30	40	50
Pb	300	100	<80	400	600	800
Pd	<1	<1	<1	<1	<1	<1
Pt	<6	<8	<8	<10	<10	<7
Rb	-	-	-	-	-	-
Sb	<1000	<600	<600	<600	<600	<1000
Sc	<4	<4	<4	<4	<4	<4
Se	-	-	-	-	-	-
Sn	420	160	27.8	170	68	5
Sr	<500	<100	<80	1	2	40
Ta	<100	<100	<100	<100	<100	<100
Te	2000	1000	1000	<1000	<900	<1000
V	<60	<50	<50	<50	<60	<80
W	-	-	-	-	-	-
Zn	300	300	200	300	300	400
	Concentration, Percent					
Al_2O_3	>7.6	>7.6	>7.6	>9.5	>9.5	>7.6
CaO	<0.3	<0.07	<0.07	<0.07	<0.10	5.6
Fe_2O_3	12.6	7.0	4.2	8.4	8.4	9.8
K_2O	10.8	>12	8.4	12	9.6	>12
MgO	0.16	0.02	0.48	0.48	0.32	0.32
MnO	0.6	0.5	0.3	0.3	0.3	>1.3
Na_2O	4.2	2.8	8.4	5.2	6.5	6.5
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
SiO_2	>21	>21	>21	>21	>21	>21
TiO_2	0.68	0.15	<0.10	0.34	0.34	0.68
LOI	-	-	-	-	-	-

Dotson - Continued

Element	12-19	12-20	12-21	12-22	12-23	12-24
	Concentration, Parts Per Million					
Ag	<40	60	<20	<10	<30	<70
As	<100	300	<200	<200	<90	<100
Au	<20	<20	<20	<20	<30	<40
B	90	100	100	100	100	100
Ba	1000	1000	20	70	90	70
Be	53	22	33	-	4	72
Bi	<400	<300	<500	40	<100	<100
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<10	<10	<10	<1	<10	<10
Cr	<5	40	20	20	20	60
Cs	-	-	-	-	-	-
Cu	<6	100	<6	<6	<6	<6
Ga	<5	<20	20	<6	<10	<20
Ge	-	-	-	-	-	-
Hf	-	-	-	-	150	-
Li	>7000	>4000	<200	300	<100	200
Mo	<1	<1	<1	<1	<1	<1
Ni	50	50	20	20	20	10
Pb	100	2000	200	100	100	90
Pd	<1	<1	<1	<1	<1	<1
Pt	<10	<9	<6	<6	<6	<8
Rb	-	-	-	-	-	-
Sb	<1000	<700	<600	600	600	<600
Sc	<4	<4	<4	<4	<4	<4
Se	-	-	-	-	-	-
Sn	82	58	75	120	<200	<40
Sr	70	20	2	4	3	2
Ta	<100	<100	100	200	<80	<80
Te	<500	<800	1000	<1000	<400	<400
V	<80	<100	<50	<50	<50	<50
W	-	-	-	-	-	-
Zn	400	900	700	500	900	700
	Concentration, Percent					
Al_2O_3	>9.5	>7.6	>9.5	>7.6	>7.6	>7.6
CaO	9.8	4.2	<0.07	0.84	0.56	<0.07
Fe_2O_3	11.2	8.4	7.0	7.0	7.0	4.2
K_2O	>12	>12	8.4	7.2	>12	>12
MgO	4.8	1.6	0.64	0.64	0.48	1.3
MnO	>2.6	>2.6	0.9	0.65	0.78	0.39
Na_2O	6.5	7.8	10.4	9.1	3.9	9.1
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
SiO_2	>21	>21	>21	>21	>21	>21
TiO_2	0.85	0.51	0.17	<0.10	0.34	<0.07
LOI	-	-	-	-	-	-

Element	12-25	12-26	12-27	12-28	12-29	12-30
			Concentration, Parts Per Million			
Ag	<40	<0.5	<5	<10	<7	<70
As	<100	4.6	<90	<100	<200	300
Au	<30	I	<20	<20	<20	<20
B	100	80	90	100	100	100
Ba	40	220	100	100	60	400
Be	55	100	4	44	14	43
Bi	<100	0.5	<200	<300	<300	<400
Br	-	<5	-	-	-	-
Cd	<5	<0.2	<5	<5	<5	<5
Co	<10	1	<10	<10	<10	<10
Cr	50	60	60	40	100	60
Cs	-	1.9	-	-	-	-
Cu	<6	3.5	<6	<6	<6	<6
Ga	<20	-	<2	<5	<2	20
Ge	-	20	-	-	-	-
Hf	-	46	-	-	150	-
Li	200	170	<20	<20	>600	80
Mo	<1	<5	<1	<1	<1	<1
Ni	10	10	8	20	10	30
Pb	300	440	<20	500	200	300
Pd	<1	-	<1	<1	<1	<1
Pt	<6	-	<6	<6	<6	<7
Rb	-	310	-	-	-	-
Sb	<60	4.4	<600	<600	<600	<600
Sc	<4	2.18	<4	<4	<4	<4
Se	-	<20	-	-	-	-
Sn	<60	-	<5	23.9	<5	35
Sr	4	20	10	<1	6	9
Ta	<80	100	<100	<100	<100	240
Te	<400	-	<50	<60	<40	<1000
V	<50	10	<50	<50	<50	<50
W	-	<5	-	-	-	-
Zn	1000	900	90	500	900	300
			Concentration, Percent			
Al_2O_3	>7.6	8.33	>7.6	>5.7	>7.6	>9.5
CaO	<0.8	0.27	0.28	0.56	0.56	0.28
Fe_2O_3	2.8	1.91	2.8	5.6	4.2	7.0
K_2O	>12	2.84	<2.2	12	3.6	12
MgO	0.96	0.33	0.80	0.48	1.3	1.1
MnO	0.26	0.16	0.10	0.78	0.39	1.17
Na_2O	6.5	3.92	9.1	5.2	10.4	7.8
P_2O_5	<1.6	0.03	<1.6	<1.6	<1.6	<1.6
SiO_2	>21	78.7	>21	>21	>21	>21
TiO_2	<0.08	0.18	<0.05	0.17	<0.05	0.34
LOI	-	0.93	-	-	-	-

Dotson - Continued

Element	12-31	12-32	12-33	12-34	12-35	12-36
			Concentration, Parts Per Million			
Ag	<20	<10	<20	<20	<10	<8
As	<100	<200	<400	<200	<200	<100
Au	<20	<20	<20	<20	<20	<20
B	100	300	<60	100	100	100
Ba	50	<20	80	300	200	100
Be	76	1600	38	32	79	81
Bi	<200	<100	<400	<300	<300	<200
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<10	<10	<10	<10	<10	<10
Cr	60	60	80	90	100	60
Cs	-	-	-	-	-	-
Cu	<6	<6	<6	<6	<6	<6
Ga	<5	<6	<4	<8	<3	<5
Ge	-	-	-	-	-	-
Hf	-	-	-	-	-	-
Li	>300	>400	<30	300	<20	<20
Mo	<1	<1	<1	<1	<1	<1
Ni	30	20	20	30	10	20
Pb	100	3000	<60	200	<40	200
Pd	<1	<1	<1	<1	<1	<1
Pt	<6	<6	<6	<6	<6	<6
Rb	-	-	-	-	-	-
Sb	<900	<600	<600	<600	<600	<600
Sc	<4	<4	<4	<4	<4	<4
Se	-	-	-	-	-	-
Sn	56	110	53	31	47	47
Sr	1	<1	<1	1	20	2
Ta	<100	<100	<100	<100	<100	<100
Te	<600	<600	<400	<900	<400	<800
V	<50	<50	<50	<50	<50	<50
W	-	-	-	-	-	-
Zn	800	4000	300	200	200	400
			Concentration, Percent			
Al_2O_3	>7.6	>5.7	>5.7	>1.6	>7.6	>5.7
CaO	0.07	<0.07	<0.07	0.14	<0.10	<0.07
Fe_2O_3	8.4	5.6	4.2	5.6	4.2	4.2
K_2O	<2.2	9.6	7.2	12	<2.2	12
MgO	0.48	0.48	0.64	0.48	0.64	0.06
MnO	0.91	1.0	0.26	0.26	0.39	0.13
Na_2O	5.2	<1.3	3.9	3.9	6.5	1.3
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
SiO_2	>21	>21	>21	>21	>21	>21
TiO_2	0.34	>0.07	0.34	0.17	0.34	<0.08
LOI	-	-	-	-	-	-

Dotson - Continued

Element	12-37	12-38	12-39	12-40	12-41	12-42
			Concentration, Parts Per Million			
Ag	<0.05	<5	<20	<9	<20	<0.5
As	13	<100	<200	<100	<100	30
Au	0.03	<20	<20	<20	<20	0.08
B	40	100	100	100	100	30
Ba	180	60	50	20	60	270
Be	120	17	290	5	130	120
Bi	<0.5	<300	<200	<200	<200	0.5
Br	2	-	-	-	-	<1
Cd	<0.2	<5	<5	<5	<5	<0.2
Co	5	<10	<10	<10	<10	<1
Cr	30	100	80	100	100	20
Cs	<0.5	-	-	-	-	<3.0
Cu	3.5	<6	<6	<6	<6	4.0
Ga	-	<2	<6	<2	<10	-
Ge	40	-	-	-	-	20
Hf	99	-	-	-	-	170
Li	50	<20	<20	<20	<20	20
Mo	<5	<1	<1	<1	<1	<5
Ni	9	10	20	10	20	13
Pb	240	<50	300	<40	500	350
Pd	-	<1	<1	<1	<1	-
Pt	-	<6	<6	<6	<6	-
Rb	120	-	-	-	-	180
Sb	3	<600	<600	<600	<600	2.5
Sc	1.7	<4	<4	<4	<4	1.9
Se	<100	-	-	-	-	I
Sn	-	15.4	140	<5	60	-
Sr	<20	9	10	5	5	<20
Ta	99	<100	<100	<100	<100	66
Te	-	<600	<900	<500	<1000	-
V	20	<50	<50	<50	<50	10
W	-	-	-	-	-	11
Zn	570	100	500	40	600	350
			Concentration, Percent			
Al_2O_3	4.92	>7.6	>5.7	>7.6	>5.7	8.57
CaO	0.17	1.0	<0.07	0.84	<0.08	0.20
Fe_2O_3	5.04	4.2	7.0	4.2	5.6	3.61
K_2O	0.97	<1.2	<1.2	3.6	7.2	3.26
MgO	0.27	0.84	0.02	0.84	0.16	0.27
MnO	0.21	0.13	0.52	0.26	0.39	0.15
Na_2O	2.67	10.4	<1.3	7.8	3.9	3.05
P_2O_5	0.12	<1.6	<1.6	<1.6	<1.6	0.12
SiO_2	82.2	>21	>21	>21	>21	77.5
TiO_2	0.31	<0.05	0.17	<0.05	<0.12	0.41
LOI	1.39	-	-	-	-	0.70

Element	12-43	12-44	12-45	12-46	12-47	12-48
			Concentration, Parts Per Million			
Ag	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
As	24	9	11	13	19	2
Au	<0.02	0.04	<0.01	<0.01	0.06	0.03
B	50	20	30	40	30	30
Ba	290	140	330	310	510	380
Be	90	50	80	90	40	180
Bi	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Br	<1	<1	<1	2	<2	<1
Cd	0.8	0.4	<0.2	<0.2	<0.2	1.0
Co	<4	6	4	<3	<1	4
Cr	30	40	20	20	20	20
Cs	<2	<0.8	6	<3	1.4	<3.0
Cu	4.5	9.0	5	6	6.5	9.0
Ga	-	-	-	-	-	-
Ge	10	40	40	30	10	20
Hf	50	65	66	32	85	26
Li	30	60	60	30	50	20
Mo	<5	<5	<5	<5	<5	<5
Ni	16	24	9	10	8	12
Pb	300	1200	330	120	300	190
Pd	-	-	-	-	-	-
Pt	-	-	-	-	-	-
Rb	240	260	260	280	260	180
Sb	4.4	1.8	4.3	1.0	1.3	0.8
Sc	2.0	0.7	4.2	1.7	2.4	2.8
Se	<100	I	<12	130	36	<3
Sn	-	-	-	-	-	-
Sr	<20	<20	<20	<20	<20	<20
Ta	92	150	90	92	120	73
Te	-	-	-	-	-	-
V	20	10	10	10	10	20
W	I	I	I	6	<3	I
Zn	440	800	1800	230	180	580
			Concentration, Percent			
Al_2O_3	8.25	5.01	8.52	8.33	8.86	9.19
CaO	0.26	0.11	0.12	0.15	0.21	0.28
Fe_2O_3	2.00	3.79	5.97	1.09	1.42	2.00
K_2O	2.43	1.49	2.52	2.96	2.45	2.07
MgO	0.30	0.24	0.25	0.18	0.20	0.25
MnO	0.20	0.14	0.12	0.07	0.08	0.16
Na_2O	3.38	2.45	3.60	3.14	4.02	4.20
P_2O_5	0.08	0.16	0.04	0.04	0.07	0.05
SiO_2	79.6	79.1	77.0	81.9	80.0	78.5
TiO_2	0.19	0.27	0.51	0.13	0.26	0.19
LOI	0.77	1.39	0.85	0.85	0.77	1.08

Dotson - Continued

Element	12-49	12-50	12-51	12-52	12-53	12-54
			Concentration, Parts Per Million			
Ag	<0.5	<9	<5	<0.5	<0.5	<0.5
As	32	<100	<200	20	7	I
Au	0.07	<20	<20	0.03	0.08	0.50
B	50	90	100	60	40	10
Ba	160	60	500	350	210	140
Be	60	71	41	120	180	70
Bi	<0.5	<100	<500	<0.5	<0.5	<0.5
Br	<2	-	-	<1	<2	<4
Cd	0.6	-	-	<0.2	0.4	<0.2
Co	<8	<10	<10	3	<3	<4
Cr	40	30	20	30	40	50
Cs	<3.0	-	-	<3.0	I	<3.0
Cu	9.5	<6	<6	4.5	10	9.0
Ga	-	<6	<2	-	-	-
Ge	30	-	-	20	30	90
Hf	98	-	-	91	35	220
Li	20	<20	<20	30	20	<10
Mo	<5	<1	<1	<5	<5	<5
Ni	25	20	10	11	17	30
Pb	1000	1000	300	230	64	120
Pd	-	<1	<1	-	-	-
Pt	-	<6	<6	-	-	-
Rb	390	-	-	200	50	20
Sb	2.8	<600	<600	1.6	1.7	<1.0
Sc	0.5	<4	<4	3.5	1.5	1.9
Se	I	-	-	<50	51	<50
Sn	-	83	19.6	-	-	-
Sr	<20	10	9	30	<20	<20
Ta	240	<100	<100	60	130	250
Te	-	<500	<400	-	-	-
V	10	<50	<50	10	10	10
W	I	-	-	I	I	I
Zn	170	600	400	510	300	140
			Concentration, Percent			
Al_2O_3	5.72	>5.6	>7.6	9.19	5.73	4.39
CaO	0.23	0.39	0.26	0.19	0.25	0.53
Fe_2O_3	1.72	3.9	3.9	2.70	2.68	3.76
K_2O	2.87	3.6	8.4	2.55	1.32	0.11
MgO	0.12	0.38	0.64	0.24	0.14	0.23
MnO	0.08	0.52	0.52	0.11	0.21	0.16
Na_2O	1.73	3.3	7.8	3.85	2.62	2.52
P_2O_5	0.19	<1.6	<1.6	0.10	0.05	0.15
SiO_2	79.7	>21	<21	78.3	82.3	80.1
TiO_2	0.14	<0.07	<0.05	0.24	0.26	0.33
LOI	1.31	-	-	0.93	1.16	1.93

Dotson - Continued

Element	12-55	12-56	12-57	12-58	12-59	12-60
Concentration, Parts Per Million						
Ag	<0.5	<0.5	<10	<20	<0.5	<0.5
As	<2	<2	<100	<200	<3	<2
Au	0.06	0.07	<20	<30	0.30	<0.01
B	<10	<10	<70	90	10	<10
Ba	280	330	60	<20	180	350
Be	10	30	30	64	40	<10
Bi	<0.5	<0.5	<20	<30	<0.5	<0.5
Br	<3	I	-	-	<1	<1
Cd	<0.2	0.6	<5	<5	0.6	0.2
Co	1	1	<10	<10	3	2
Cr	20	30	40	20	60	20
Cs	0.8	1.1	-	-	<2.0	0.8
Cu	3.5	3.0	<6	<6	34	11
Ga	-	-	<2	<2	-	-
Ge	10	10	-	-	70	10
Hf	35	63	-	-	130	14
Li	<10	<10	<30	<20	<10	<10
Mo	<5	<5	<1	<1	<5	<5
Ni	3	4	20	20	35	2
Pb	24	230	100	<70	230	50
Pd	-	-	<1	<1	-	-
Pt	-	-	<6	<6	-	-
Rb	40	60	-	-	30	40
Sb	0.7	0.5	<600	<600	1.2	0.2
Sc	3.7	3.3	<4	<4	0.5	4.3
Se	18	24	-	-	I	<5
Sn	-	-	29.1	68	-	-
Sr	100	60	7	20	80	120
Ta	48	47	<100	<100	230	21
Te	-	-	<600	<700	-	-
V	10	10	<50	<50	40	10
W	10	8	I	I	I	<3
Zn	62	80	600	300	130	56
Concentration, Percent						
Al_2O_3	11.4	10.1	>5.6	>5.79	5.27	12.0
CaO	0.37	0.27	<0.13	0.39	1.16	0.37
Fe_2O_3	1.50	1.75	3.9	4.2	3.07	1.52
K_2O	0.88	1.45	4.8	<0.7	0.29	1.12
MgO	0.32	0.24	0.80	0.32	0.28	0.48
MnO	0.05	0.07	0.26	0.39	0.15	0.04
Na_2O	5.95	5.10	5.2	3.6	2.45	6.22
P_2O_5	0.03	0.04	<1.6	<1.6	0.08	0.02
SiO_2	77.8	78.5	<21	>21	73.2	76.8
TiO_2	0.16	0.19	<0.05	<0.05	0.32	0.16
LOI	1.00	1.47	-	-	1.70	1.08

Dotson - Continued

Element	12-61	12-62	12-63	12-64	12-65	12-66
			Concentration, Parts Per Million			
Ag	<0.5	<0.5	<0.5	<10	<0.5	<5
As	<4	<0.45	I	<200	28	<200
Au	0.20	<0.01	I	<20	0.01	<20
B	<10	20	20	100	50	90
Ba	160	440	260	<20	260	100
Be	110	10	40	94	130	29
Bi	<0.5	<0.5	<0.5	<200	<0.5	<300
Br	<4	1	<1	-	1	-
Cd	<0.2	<0.2	0.6	<5	0.2	<5
Co	1	1	10	<10	2	<10
Cr	50	10	90	<9	30	10
Cs	<2.0	1.3	6.9	-	1.8	-
Cu	6.0	4.0	7.0	<6	4.5	<6
Ga	-	-	-	<2	-	<2
Ge	40	10	10	-	<10	-
Hf	100	8	28	-	55	-
Li	<10	<10	20	<20	70	<20
Mo	<5	<5	<5	<1	<5	<1
Ni	24	1	40	10	7	10
Pb	320	26	86	900	250	90
Pd	-	-	-	0.024	-	<1
Pt	-	-	-	<0.01	-	<6
Rb	20	110	400	-	190	-
Sb	2.0	<0.2	1.6	<600	2.4	<600
Sc	1.1	3.94	10.9	<4	4.0	<4
Se	I	<3	<50	-	<50	-
Sn	-	-	-	62	-	51
Sr	20	50	40	20	40	10
Ta	110	8	65	<100	66	<100
Te	-	-	-	<600	-	<400
V	30	<10	90	<50	10	<50
W	I	<3	I	-	I	-
Zn	150	49	380	1000	630	200
			Concentration, Percent			
Al_2O_3	6.03	11.7	14.1	>5.7	9.48	>5.7
CaO	0.65	0.20	1.02	1.04	0.26	<0.10
Fe_2O_3	1.75	1.23	4.93	3.9	2.64	3.9
K_2O	0.18	2.85	2.16	<0.72	1.42	3.6
MgO	0.22	0.14	3.75	0.32	0.50	0.32
MnO	0.14	0.05	0.19	0.91	0.11	0.39
Na_2O	3.68	5.04	5.57	3.9	5.00	5.2
P_2O_5	0.07	0.02	0.12	<1.6	0.05	<1.6
SiO_2	78.6	77.8	63.1	>21	77.5	>21
TiO_2	0.21	0.13	0.40	<0.05	0.22	<0.05
LOI	1.85	0.39	2.39	-	1.12	-

Dotson - Continued

Element	12-67	12-68	12-69	12-70	12-71	12-72
			Concentration, Parts Per Million			
Ag	<9	<20	<40	50	<5	<6
As	<200	<200	<200	300	<100	<100
Au	<20	<20	<30	<30	<20	<20
B	100	100	100	100	<80	<80
Ba	50	400	100	700	300	300
Be	210	97	440	430	120	7
Bi	<200	<400	<100	<200	<100	<400
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	90	<5
Co	<10	<10	<10	<10	<10	<10
Cr	40	10	20	30	40	50
Cs	-	-	-	-	-	-
Cu	<6	<6	<6	<6	<6	<6
Ga	<2	<10	20	<20	<6	<2
Ge	-	-	-	-	-	-
Hf	-	-	71	I	-	-
Li	<20	60	300	<20	30	<20
Mo	<1	<1	<1	<1	<1	<1
Ni	10	30	20	40	20	50
Pb	<40	900	6000	200	400	<30
Pd	<1	<1	<1	0.022	<1	<1
Pt	<6	<6	<6	0.01	<6	<6
Rb	-	-	-	-	-	-
Sb	<800	<1000	<1000	<600	<700	<600
Sc	<4	<4	<4	<4	<4	<4
Se	-	-	-	-	-	-
Sn	43	75	200	180	110	<50
Sr	20	200	40	60	20	200
Ta	<100	<100	<100	<100	<100	<100
Te	<800	<900	<1000	<800	<400	<400
V	<50	<50	<50	<50	<50	<100
W	-	-	-	-	-	-
Zn	2000	1000	3000	2000	6000	600
			Concentration, Percent			
Al_2O_3	>3.8	>5.7	>5.7	>5.7	>5.7	>7.6
CaO	<0.13	5.2	<0.52	1.3	3.9	7.8
Fe_2O_3	5.2	9.1	5.2	3.9	5.2	9.1
K_2O	<0.72	9.6	2.4	3.6	<2.4	2.4
MgO	1.12	1.6	0.16	0.16	1.6	3.2
MnO	>3.9	>2.6	>3.9	>2.6	>3.9	1.2
Na_2O	<1.3	6.5	6.5	3.9	<0.39	3.9
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
SiO_2	>21	>21	>21	>21	>21	>21
TiO_2	<0.11	0.51	0.34	<0.07	0.17	0.34
LOI	-	-	-	-	-	-

Dotson - Continued

Element	12-73	12-74	12-75	12-76	12-77	12-78
			Concentration, Parts Per Million			
Ag	<0.5	<0.5	1.5	<0.5	<0.5	<0.5
As	I	4.3	I	I	I	I
Au	I	0.01	I	I	I	I
B	20	10	40	30	70	30
Ba	290	490	220	210	280	130
Be	130	80	460	40	60	560
Bi	1.0	<0.5	4.0	<0.5	<0.5	<0.5
Br	<4	1	<5	<1	<5	<3
Cd	7.0	0.8	34	0.4	<0.2	<0.2
Co	9	25	5	8	10	1
Cr	140	120	50	30	40	30
Cs	6.5	6.7	<1.4	1.5	<1.3	<0.8
Cu	20	36	32	7.0	6.0	5.0
Ga	-	-	-	-	-	-
Ge	30	10	40	20	30	20
Hf	34	7	82	30	61	49
Li	100	100	<10	<10	10	<10
Mo	<5	<5	<5	<5	<5	<5
Ni	63	55	30	8	20	8
Pb	460	150	960	54	120	120
Pd	-	-	-	-	-	-
Pt	-	-	-	-	-	-
Rb	620	820	50	80	150	440
Sb	4.1	1.0	3.4	2.3	3.9	3.5
Sc	12.3	24.5	2.60	16.5	11.2	1.34
Se	<6	<3	<9	3000	<30	44
Sn	-	-	-	-	-	-
Sr	240	210	170	430	260	20
Ta	100	21	260	52	85	160
Te	-	-	-	-	-	-
V	180	200	60	160	120	20
W	I	<4	I	I	I	I
Zn	750	1600	5100	190	490	5100
			Concentration, Percent			
Al_2O_3	10.6	14.8	5.28	12.7	11.0	4.29
CaO	3.93	2.84	2.04	5.37	3.22	0.31
Fe_2O_3	6.94	9.77	2.93	9.67	6.45	1.77
K_2O	2.06	3.00	0.22	0.76	1.06	0.14
MgO	4.46	6.16	0.54	3.02	2.20	0.10
MnO	0.49	0.41	0.70	0.33	0.27	0.24
Na_2O	2.75	4.14	2.37	2.92	3.41	2.64
P_2O_5	0.21	0.24	0.15	0.24	0.21	0.08
SiO_2	58.2	53.1	69.0	56.2	57.2	83.7
TiO_2	0.61	0.81	0.47	1.00	0.82	0.29
LOI	2.77	2.77	2.31	2.47	2.70	0.77

Dotson - Continued

Element	12-79	12-80	12-81	12-82	12-83	12-84
			Concentration, Parts Per Million			
Ag	<0.5	<5	<20	<10	<6	<0.5
As	<8	<200	<90	<200	<200	<2
Au	<0.01	<20	<20	<20	<20	<0.01
B	20	100	<40	90	100	<10
Ba	150	600	30	100	<20	190
Be	50	19	100	71	110	<10
Bi	<0.5	<500	<300	<300	<300	<0.5
Br	<1	-	-	-	-	1
Cd	3.6	<5	<5	<5	<5	<0.2
Co	<1	<10	<10	<10	<10	33
Cr	70	<5	<8	10	50	30
Cs	<4.0	-	-	-	-	0.7
Cu	12	<6	<6	<6	<6	45
Ga	-	<2	<2	<3	<10	-
Ge	20	-	-	-	-	<10
Hf	28	-	-	-	-	1
Li	10	4000	3000	4000	1000	<10
Mo	<5	<1	<1	<1	<1	<5
Ni	56	10	<20	8	10	15
Pb	200	<50	3000	2000	<30	<2
Pd	-	<1	<1	<1	<1	-
Pt	-	<6	<6	<6	<6	-
Rb	<20	-	-	-	-	30
Sb	<0.2	<60	<1000	<600	<600	0.2
Sc	1.1	<4	<4	<4	<4	36.7
Se	<3	-	-	-	-	<3
Sn	-	6.0	6.0	10.4	21.3	-
Sr	120	80	40	80	<1	400
Ta	52	<100	<100	<100	<100	<1
Te	-	<400	<700	<600	<500	-
V	60	<50	<50	<60	<50	330
W	I	-	-	-	-	<3
Zn	400	400	3000	1000	600	73
			Concentration, Percent			
Al_2O_3	4.15	>9.5	>5.7	>7.6	>7.6	16.2
CaO	1.59	3.9	<0.78	3.9	0.26	9.69
Fe_2O_3	2.43	5.2	3.9	3.9	5.2	15.2
K_2O	0.05	8.4	4.8	6.0	>12	1.10
MgO	0.17	1.6	1.3	1.4	0.05	5.96
MnO	0.34	0.39	>9.1	>3.9	0.26	0.24
Na_2O	1.69	13	9.1	10.4	11.71	2.20
P_2O_5	0.10	<1.6	<1.6	<1.6	<1.6	0.14
SiO_2	75.4	>21	>21	>21	>21	45.6
TiO_2	0.20	0.17	<0.07	<0.11	<0.05	1.45
LOI	1.23	-	-	-	-	2.08

Dotson - Continued

Element	12-85	12-86	12-87			
	Concentration, Parts Per Million					
Ag	<0.5	<0.5	<0.5			
As	<8	67	24			
Au	<0.01	0.07	0.08			
B	60	20	60			
Ba	180	90	160			
Be	70	170	140			
Bi	<0.5	<0.5	<0.5			
Br	<1	<1	<1			
Cd	2.2	0.4	0.6			
Co	20	3	<4			
Cr	30	50	80			
Cs	11.6	<1.0	<10.0			
Cu	11	29	19			
Ga	-	-	-			
Ge	10	40	50			
Hf	28	120	63			
Li	30	10	<10			
Mo	<5	<5	<5			
Ni	25	31	61			
Pb	120	360	98			
Pd	-	-	-			
Pt	-	-	-			
Rb	350	20	20			
Sb	2.1	4.5	0.3			
Sc	12.2	2.4	1.3			
Se	<10	<20	I			
Sn	-	-	-			
Sr	240	60	170			
Ta	48	140	140			
Te	-	-	-			
V	190	60	90			
W	I	17	<4			
Zn	710	320	490			
	Concentration, Percent					
Al_2O_3	10.6	4.78	5.64			
CaO	5.05	1.85	1.71			
Fe_2O_3	8.43	4.66	2.84			
K_2O	1.62	0.11	0.11			
MgO	2.66	0.30	0.26			
MnO	0.39	0.23	0.36			
Na_2O	3.04	1.99	2.42			
P_2O_5	0.17	0.10	0.13			
SiO_2	59.4	80.1	69.9			
TiO_2	0.80	0.38	0.24			
LOI	2.47	1.23	1.77			

Cheri

Element	13-1	13-2	13-3	13-4	13-5	13-6
			Concentration, Parts Per Million			
Ag	<0.5	<0.5	<0.5	<0.5	-	-
As	I	4	96	110	<90	<90
Au	I	0.03	0.08	<0.04	-	-
B	30	20	40	40	100	200
Ba	150	330	210	130	30	200
Be	50	130	150	150	160	340
Bi	<0.5	<0.5	0.5	0.5	<100	<100
Br	4	<1	<1	<3	-	-
Cd	1.0	<0.2	2.0	1.8	<5	<5
Co	2	18	<8	<4	<10	<10
Cr	30	40	50	60	30	30
Cs	1.0	3.2	<0.7	<0.8	-	-
Cu	4.0	38	8.0	7.5	<6	<6
Ga	-	-	-	-	<20	<10
Ge	10	20	30	30	-	-
Hf	54	44	140	160	200	140
Li	60	30	10	50	<20	>300
Mo	<5	<5	<5	<5	<1	<1
Ni	10	24	29	33	20	20
Pb	200	130	540	760	100	500
Pd	-	-	-	-	<1	<1
Pt	-	-	-	-	<50	<6
Rb	30	270	170	20	-	-
Sb	20	0.4	3.7	3.2	<600	<600
Sc	4.31	16.9	0.4	0.8	<4	<4
Se	<30	40	360	I	-	-
Sn	-	-	-	-	170	81
Sr	60	210	60	<20	7	3
Ta	60	46	150	67	<80	<80
Te	-	-	-	-	<400	<400
V	20	190	20	50	<50	<50
W	I	I	I	<3	-	-
Zn	840	660	360	960	600	1000
			Concentration, Percent			
Al_2O_3	11.2	11.7	4.48	4.76	>5.7	>5.7
CaO	0.63	3.87	0.48	0.20	<0.7	<0.14
Fe_2O_3	2.63	7.84	4.02	4.61	7.0	6.6
K_2O	0.35	1.29	1.97	0.12	9.6	12
MgO	0.64	3.52	0.11	0.08	0.32	1.6
MnO	0.18	0.36	0.25	0.21	>2.6	>2.6
Na_2O	6.98	4.08	1.55	4.78	3.9	5.2
P_2O_5	0.10	0.11	0.14	0.10	<1.6	<1.6
SiO_2	73.8	63.5	80.6	78.2	>21	>21
TiO_2	0.25	0.60	0.36	0.42	0.32	0.32
LOI	1.31	1.70	0.70	0.85	-	-

Element	13-7	13-8	13-9	13-10	13-11	13-12
	Concentration, Parts Per Million					
Ag	-	<0.3	<0.3	<0.3	<0.3	<0.3
As	<200	<600	<500	<100	<90	<90
Au	-	<0.007	<0.007	<0.007	<0.007	<0.007
B	100	300	<70	100	1000	700
Ba	300	200	500	70	200	200
Be	25	160	7.9	<0.5	340	220
Bi	<200	<100	<100	<200	<200	<100
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<10	<10	<10	<10	<10	<10
Cr	20	10	60	<3	40	30
Cs	-	-	-	-	-	-
Cu	<6	<6	<6	<6	<6	<6
Ga	<2	<3	<2	<2	40	30
Ge	-	-	-	-	-	-
Hf	-	-	-	-	110	120
Li	<20	<2	<20	<20	<20	<20
Mo	<1	<1	<1	<1	<1	<1
Ni	30	20	40	<7	30	<10
Pb	<60	200	<20	<30	400	400
Pd	<1	<1	<1	<1	<1	<1
Pt	<6	<6	<6	<6	<40	<30
Rb	-	-	-	-	-	-
Sb	<600	<600	<600	<600	<600	<600
Sc	<4	<4	<4	<4	<4	<4
Se	-	-	-	-	-	-
Sn	8.0	16.6	<5.0	<5.0	20.2	27.5
Sr	400	300	100	70	200	70
Ta	<80	<80	<80	<80	100	100
Te	<400	<400	<400	<400	<400	<400
V	<50	<50	200	<50	200	200
W	-	-	-	-	-	-
Zn	500	2000	900	<1	900	1000
	Concentration, Percent					
Al_2O_3	>7.6	>9.5	>9.5	>9.5	>7.6	>7.6
CaO	12.0	5.6	12.6	5.6	7.0	4.2
Fe_2O_3	7.0	8.4	9.8	4.2	7.0	7.0
K_2O	>12	3.6	7.2	<0.72	<0.72	<0.72
MgO	3.2	1.3	>13.0	2.6	0.64	0.64
MnO	0.91	>2.6	1.17	0.09	>2.6	>3.9
Na_2O	1.3	<0.39	2.6	7.8	<0.39	1.3
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
SiO_2	>21	>21	>21	>21	>21	>21
TiO_2	<0.10	0.17	0.68	<0.05	0.51	0.51
LOI	-	-	-	-	-	-

Cheri - Continued

Element	13-13	13-14	13-15	13-16	13-17	13-18
			Concentration, Parts Per Million			
Ag	<0.3	<0.3	<0.3	<0.3	<0.5	<0.5
As	<500	<400	<100	<90	45	32
Au	<0.007	<0.007	<0.007	<0.007	0.01	I
B	<60	1000	90	<70	50	70
Ba	400	200	300	300	290	160
Be	7.7	1100	9.7	41	120	200
Bi	<200	<100	<100	<100	<0.5	<0.5
Br	-	-	-	-	<1	<12
Cd	<5	<5	<5	<5	0.6	14
Co	<10	<10	<10	<10	22	<4
Cr	10	10	<7	<6	20	50
Cs	-	-	-	-	3.7	<1.0
Cu	<6	<6	7	<6	20	6.5
Ga	<2	<2	<2	<2	-	-
Ge	-	-	-	-	10	20
Hf	-	-	-	-	56	160
Li	<20	<20	<20	<20	40	30
Mo	<1	<1	<1	<1	<5	<5
Ni	<2	<10	20	10	10	22
Pb	<20	<20	<30	<40	640	280
Pd	<1	<1	<1	<1	-	-
Pt	<6	<6	<6	<6	-	-
Rb	-	-	-	-	150	60
Sb	<700	<600	<1000	<600	5.3	5.2
Sc	<4	<4	<4	<4	17.9	1.8
Se	-	-	-	-	<50	I
Sn	<5.0	48	<5.0	<5.0	-	-
Sr	100	90	90	90	220	200
Ta	100	80	<80	<80	60	93
Te	<400	<400	<400	<400	-	-
V	200	<50	200	<100	260	40
W	-	-	-	-	I	I
Zn	200	3000	300	700	1800	1200
			Concentration, Percent			
Al_2O_3	>9.5	>5.7	>7.6	>7.6	10.5	5.99
CaO	9.8	1.4	12.0	7.0	4.96	1.44
Fe_2O_3	12.0	4.2	8.4	7.0	10.3	4.73
K_2O	<0.72	<0.72	<0.72	<0.72	1.01	0.43
MgO	3.2	0.80	3.2	3.2	2.73	0.35
MnO	>1.31	>7.8	>1.3	>1.3	0.32	0.64
Na_2O	3.9	<0.52	2.6	2.6	3.79	4.86
P_2O_5	<1.6	<1.6	<1.6	<1.6	0.10	0.11
SiO_2	>21	>21	>21	>21	61.7	73.0
TiO_2	0.68	<0.10	0.68	0.51	1.10	0.43
LOI	-	-	-	-	1.23	1.54

Cheri - Continued

Element	13-19	13-20	13-21	13-22		
	Concentration, Parts Per Million					
Ag	<0.5	<0.5	<0.5	<0.5		
As	4	<8	10	I		
Au	0.04	0.02	<0.01	I		
B	110	<10	40	30		
Ba	290	80	180	400		
Be	150	40	90	90		
Bi	<0.5	<0.5	<0.5	<0.5		
Br	<3	<5	1	1		
Cd	<0.2	<0.2	0.4	1.0		
Co	11	<3	13	18		
Cr	60	60	110	160		
Cs	<3.0	<4.0	2.2	3.5		
Cu	20	57	7.5	39		
Ga	-	-	-	-		
Ge	20	60	<10	10		
Hf	69	150	69	66		
Li	<10	<10	10	10		
Mo	<5	<5	<5	<5		
Ni	21	40	29	51		
Pb	190	34	110	76		
Pd	-	-	-	-		
Pt	-	-	-	-		
Rb	40	30	130	250		
Sb	1.2	1.6	1.5	1.1		
Sc	12.8	4.7	12.0	17.3		
Se	<50	<70	<50	<50		
Sn	-	-	-	-		
Sr	440	690	190	210		
Ta	52	250	110	70		
Te	-	-	-	-		
V	120	300	110	260		
W	I	I	I	I		
Zn	640	85	790	490		
	Concentration, Percent					
Al_2O_3	11.3	16.6	8.99	10.8		
CaO	6.32	14.7	4.31	4.72		
Fe_2O_3	6.89	12.0	6.48	10.7		
K_2O	0.64	0.04	0.68	1.39		
MgO	2.45	1.58	2.94	5.16		
MnO	0.32	0.33	0.46	0.42		
Na_2O	3.22	0.27	3.34	2.33		
P_2O_5	I	0.31	0.11	0.05		
SiO_2	64.9	35.3	68.7	57.1		
TiO_2	0.57	0.67	0.46	0.88		
LOI	1.23	2.93	1.47	3.93		

Upper Cheri

Element	14-1	14-2	14-3	14-4	14-5	14-6
			Concentration, Parts Per Million			
Ag	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
As	<2	3	4	17	24	5.7
Au	0.020	0.020	I	0.010	I	<10
B	20	<10	<10	30	50	10
Ba	230	250	460	410	120	510
Be	90	70	50	20	50	30
Bi	<0.5	<0.5	<0.5	<0.5	0.5	0.5
Br	1	<1	<60	<1	<1	<2
Cd	<0.2	<0.2	<0.2	1.6	6.8	1.0
Co	12	17	12	18	<4	28
Cr	30	140	20	130	50	220
Cs	<1.0	2.5	3.8	1.6	<4.0	7.9
Cu	22	18	35	22	9.5	64
Ga	-	-	-	-	-	-
Ge	10	20	10	10	10	<10
Hf	40	34	190	26	71	28
Li	<10	<10	<10	<10	<10	<10
Mo	<5	<5	<5	<5	<20	<5
Ni	16	37	4	36	19	68
Pb	40	38	96	100	220	96
Pd	-	-	-	-	-	-
Pt	-	-	-	-	-	-
Rb	10	150	200	100	30	430
Sb	0.6	0.2	2.1	2.1	4.1	0.6
Sc	16.6	26.3	17.3	23.1	0.82	30.1
Se	<3	<3	<3	<3	I	18
Sn	-	-	-	-	-	-
Sr	330	290	270	290	80	280
Ta	29	35	30	37	48	13
Te	-	-	-	-	-	-
V	170	200	190	230	20	190
W	11	<5	<3	<3	I	<3
Zn	210	320	330	610	730	460
			Concentration, Percent			
Al_2O_3	12.1	12.4	12.9	12.5	2.07	13.9
CaO	6.01	5.82	3.79	6.38	1.12	5.93
Fe_2O_3	7.79	8.50	7.44	9.03	5.76	8.16
K_2O	0.62	0.85	1.20	1.10	0.06	2.40
MgO	2.98	4.53	2.66	4.20	0.32	6.40
MnO	0.24	0.38	0.39	0.45	0.95	0.34
Na_2O	3.37	4.06	4.90	3.15	0.83	3.55
P_2O_5	0.14	0.14	0.18	0.06	0.08	0.12
SiO_2	62.6	60.8	63.3	58.9	81.4	55.6
TiO_2	0.65	0.73	0.80	0.72	0.33	0.58
LOI	1.85	1.00	1.16	1.93	1.23	1.70

Element	14-7	14-8	14-9	14-10	14-11	14-12
	Concentration, Parts Per Million					
Ag	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
As	2	I	27	18	7.3	7.6
Au	<10	I	0.020	0.010	<10	<10
B	20	20	60	40	60	60
Ba	130	230	320	220	590	530
Be	20	140	70	30	20	40
Bi	<0.5	0.5	<0.5	<0.5	<0.5	<0.5
Br	2	<1	<1	I	<1	<1
Cd	<0.2	0.8	0.8	1.0	<0.2	<0.2
Co	16	17	19	12	2	3
Cr	30	170	60	40	10	20
Cs	0.9	2.9	7.7	4.5	1.6	1.5
Cu	150	210	4.0	1.5	2.5	7.5
Ga	-	-	-	-	-	-
Ge	10	10	10	10	10	10
Hf	18	57	14	15	19	25
Li	<10	<10	370	340	20	<10
Mo	<5	<5	<5	<5	<5	<5
Ni	13	40	24	20	3	6
Pb	20	280	460	220	78	64
Pd	-	-	-	-	-	-
Pt	-	-	-	-	-	-
Rb	40	110	720	600	240	70
Sb	0.3	0.8	4.8	4.5	1.3	1.3
Sc	4.37	12.2	17.2	13.9	6.50	5.85
Se	14	46	<3	<5	<3	<3
Sn	-	-	-	-	-	-
Sr	130	250	390	550	100	140
Ta	37	100	28	26	13	20
Te	-	-	-	-	-	-
V	30	130	100	120	10	20
W	5	I	<5	<5	I	I
Zn	81	570	2000	810	350	190
	Concentration, Percent					
Al_2O_3	10.3	8.06	13.6	13.3	12.6	16.4
CaO	2.67	6.51	4.37	6.08	0.76	0.66
Fe_2O_3	3.47	7.34	6.30	6.37	2.01	2.19
K_2O	0.21	0.62	1.71	2.00	2.74	1.43
MgO	0.99	2.93	3.31	2.70	0.64	0.84
MnO	0.17	0.42	0.33	0.27	0.10	0.09
Na_2O	4.95	2.16	6.52	5.07	4.91	7.88
P_2O_5	0.05	0.11	0.16	0.13	0.05	0.05
SiO_2	75.0	65.1	59.2	61.6	75.0	67.9
TiO_2	0.21	0.39	0.58	0.48	0.21	0.23
LOI	0.93	1.39	2.70	1.70	0.77	1.16

Upper Cheri - Continued

Element	14-13	14-14				
		Concentration, Parts Per Million				
Ag	<0.5	<0.5				
As	I	77				
Au	0.040	I				
B	20	280				
Ba	340	360				
Be	20	270				
Bi	<0.5	1.0				
Br	<1	<1				
Cd	<0.2	2.6				
Co	1	4				
Cr	30	30				
Cs	1.3	2.7				
Cu	9.5	11				
Ga	-	-				
Ge	10	20				
Hf	71	90				
Li	<10	10				
Mo	<5	<5				
Ni	9	17				
Pb	46	840				
Pd	-	-				
Pt	-	-				
Rb	80	280				
Sb	0.8	14				
Sc	4.87	1.80				
Se	<9	I				
Sn	-	-				
Sr	50	100				
Ta	36	57				
Te	-	-				
V	30	50				
W	I	I				
Zn	170	4000				
		Concentration, Percent				
Al_2O_3	9.48	6.95				
CaO	0.45	1.00				
Fe_2O_3	3.27	5.42				
K_2O	1.16	1.78				
MgO	0.80	1.13				
MnO	0.09	0.44				
Na_2O	4.52	3.53				
P_2O_5	0.11	0.13				
SiO_2	76.6	71.2				
TiO_2	0.34	0.43				
LOI	0.77	1.23				

Geoduck and Shore

Element	15-1	15-2	15-3	15-4	15-5	15-6
			Concentration, Parts Per Million			
Ag	<0.3	2.36	<0.3	<0.3	<0.3	<0.3
As	<1000	<200	<900	<100	<600	<200
Au	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007
B	400	300	400	500	<100	200
Ba	200	60	600	600	400	800
Be	190	250	220	720	1500	130
Bi	<200	<100	<100	<100	<100	<200
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<30	<10	<10	<10	<10	<10
Cr	20	30	10	40	<8	10
Cs	<5	<5	<5	<5	<5	<5
Cu	<6	30	<6	<6	<6	<6
Ga	20	<2	<4	<10	<2	<2
Ge	-	-	-	-	-	-
Hf	130	-	-	68	-	-
Li	<20	<20	<20	<20	<20	<20
Mo	<1	<1	<1	<1	<1	<1
Ni	20	<10	<10	<20	<10	<7
Pb	900	1000	3000	500	<50	<50
Pd	<1	<1	<1	<1	<1	<1
Pt	<6	<8	<6	<50	<10	<6
Rb	34	25.3	52	50	52	26.7
Sb	<600	<600	<600	<1000	<2000	<1000
Sc	<4	<4	<4	<4	<4	<4
Se	-	-	-	-	-	-
Sn	97	73	26.9	120	37	<5
Sr	70	40	80	100	60	100
Ta	<80	<80	<80	<80	<80	<80
Te	<400	<400	<400	<400	<400	<400
V	200	<50	<50	<50	<50	<50
W	-	-	-	-	-	-
Zn	500	500	3000	2000	4000	2000
			Concentration, Percent			
Al_2O_3	>7.6	>5.7	>11.4	>7.6	>5.7	>9.5
CaO	1.3	<0.26	1.3	<0.91	<2.6	3.9
Fe_2O_3	6.5	6.5	7.8	5.2	3.9	6.5
K_2O	<0.72	9.6	<2.6	<0.72	>12	6.5
MgO	0.96	1.6	1.6	0.80	0.69	1.6
MnO	>2.6	>3.9	>5.2	>7.8	>13	>2.6
Na_2O	<1.3	<0.3	10.4	5.2	<3.9	13
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
SiO_2	>21	>21	>21	>21	>21	>21
TiO_2	0.51	0.17	0.34	0.34	0.05	0.51
LOI	-	-	-	-	-	-

Geoduck and Shore - Continued

Element	15-7	15-8	15-9	15-10	15-11	15-12
	Concentration, Parts Per Million					
Ag	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
As	<90	300	<90	<90	<90	<100
Au	<0.007	<0.007	<0.007	0.106	<0.007	<0.007
B	<60	600	<60	700	400	200
Ba	100	100	100	300	1000	40
Be	3.5	140	560	1000	650	430
Bi	<100	<100	<100	<100	<100	<100
Br	-	-	-	-	-	-
Cd	<5	<5	<5	<5	<5	<5
Co	<10	<10	<10	<10	<10	<10
Cr	10	20	10	30	10	40
Cs	<5	<5	<5	<5	<5	<5
Cu	<6	<6	<6	<6	<6	<6
Ga	<2	<8	<2	<2	<2	<7
Ge	-	-	-	-	-	-
Hf	-	-	74	-	-	99
Li	<20	<20	<20	<20	<20	<20
Mo	<1	<1	<1	<1	<1	<1
Ni	<3	<10	<3	<2	<20	<3
Pb	<20	-	-	<50	<40	400
Pd	<1	<1	<1	<1	<1	<1
Pt	<6	<4	<6	<6	<20	<4
Rb	43	28.1	12.3	23.9	28.8	<5
Sb	<600	<1000	<600	<800	<2000	<1000
Sc	<4	<4	<4	<4	<4	<4
Se	-	-	-	-	-	-
Sn	<5	<5	23.2	20.2	20.2	31
Sr	4	500	4	90	300	200
Ta	<80	<80	<80	<80	<80	<80
Te	<400	<400	<400	<400	<400	<400
V	<50	<50	<50	<50	<50	<50
W	-	-	-	-	-	-
Zn	10	1000	10	4000	3000	1000
	Concentration, Percent					
Al_2O_3	>7.6	>5.7	>7.6	>7.6	>7.6	>7.6
CaO	0.65	5.2	6.5	3.9	7.8	3.9
Fe_2O_3	2.6	6.5	2.6	2.6	9.1	5.2
K_2O	>12	<7.8	>12	12	>12	<0.78
MgO	0.10	1.28	0.10	1.28	1.6	0.96
MnO	0.10	>3.9	0.10	3.9	>5.2	>6.5
Na_2O	6.5	1.17	6.5	2.6	<2.6	<0.91
P_2O_5	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
SiO_2	>21	>21	>21	>21	>21	>21
TiO_2	<0.05	0.68	<0.05	0.10	1.36	0.34
LOI	-	-	-	-	-	-

Geoduck and Shore - Continued

Element	15-13	15-14	15-15	15-16	15-17	15-18
Concentration, Parts Per Million						
Ag	<0.3	<0.3	<0.3	<0.5	<0.5	<0.5
As	300	<100	<200	2.8	19	1.2
Au	<0.007	<0.007	<0.007	<0.01	I	<0.01
B	300	100	100	20	50	10
Ba	4000	200	60	240	I	530
Be	130	12	6.6	40	180	<10
Bi	<100	<100	<200	<0.5	0.5	<0.5
Br	-	-	-	2	<1	1
Cd	<5	<5	<5	<0.2	2	0.2
Co	<10	<10	<10	19	10	14
Cr	80	40	20	10	I	10
Cs	<5	<5	<5	4.9	13.6	1.7
Cu	<6	<6	<6	12	8.5	4.5
Ga	<2	<8	<2	-	-	-
Ge	-	-	-	10	30	10
Hf	-	-	-	4	61	2
Li	>500	<20	<20	50	290	10
Mo	<1	<1	<1	<5	<5	<5
Ni	20	<6	<3	8	14	6
Pb	400	<40	<20	380	900	20
Pd	<1	<1	<1	-	-	-
Pt	<1	<6	<6	-	-	-
Rb	94	56	45	150	I	130
Sb	<1000	<600	<600	0.5	9.4	0.3
Sc	<4	<4	<4	29.1	10.9	7.8
Se	-	-	-	<3	I	<3
Sn	26.9	9	<5	-	-	-
Sr	100	6	10	700	I	1100
Ta	<80	<80	<80	2	110	1
Te	<400	<400	<400	-	-	-
V	<50	<50	<50	270	120	120
W	-	-	-	<3	I	<3
Zn	2000	40	70	360	5500	150
Concentration, Percent						
Al_2O_3	>9.5	>9.5	>7.6	14.5	I	18.7
CaO	6.5	<0.13	3.9	7.8	I	6.32
Fe_2O_3	5.2	3.9	2.6	10.6	I	7.05
K_2O	5.2	>12	>12	0.86	I	1.33
MgO	1.6	0.08	0.03	2.49	I	2.51
MnO	>5.2	0.13	0.26	0.27	I	0.14
Na_2O	11.7	13	10.4	4.73	I	4.97
P_2O_5	<1.6	<1.6	<1.6	0.10	I	0.26
SiO_2	>21	>21	>21	55.0	I	56.4
TiO_2	0.51	<0.05	<0.05	0.77	I	0.48
LOI	-	-	-	2.00	I	1.31

Geoduck and Shore - Continued

Element	15-19	15-20	15-21	15-22	15-23	15-24
Concentration, Parts Per Million						
Ag	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
As	I	<2	23	2.2	I	<0.61
Au	I	<0.01	I	<0.01	I	0.01
B	30	<10	300	10	80	10
Ba	310	90	200	170	190	280
Be	150	<10	360	<10	280	<10
Bi	1.5	1.0	0.5	<0.5	<0.5	<0.5
Br	<1	<1	<2	1	1	1
Cd	0.2	<0.2	1.8	<0.2	1.4	<0.2
Co	<1	<1	2	28	2	30
Cr	40	10	50	80	40	170
Cs	1.0	0.6	<2	<0.8	1.3	1.2
Cu	23	2.5	48	17	6	6
Ga	-	-	-	-	-	-
Ge	20	10	40	10	20	<10
Hf	90	17	130	2	93	3
Li	10	<10	<10	10	<10	<10
Mo	<5	<5	<5	<5	<5	<5
Ni	18	<1	27	32	20	50
Pb	440	24	520	16	120	4
Pd	-	-	-	-	-	-
Pt	-	-	-	-	-	-
Rb	80	290	210	50	30	80
Sb	0.8	<0.2	4.3	0.4	6.1	0.5
Sc	2.28	0.2	1.8	38.3	1.54	38.0
Se	<50	<3	I	<3	I	<3
Sn	-	-	-	-	-	-
Sr	80	<20	140	660	190	330
Ta	51	3	81	1	89	2
Te	-	-	-	-	-	-
V	40	<10	50	370	40	260
W	I	<3	I	<3	I	<3
Zn	320	53	1500	140	650	130
Concentration, Percent						
Al_2O_3	8.5	11.0	5.01	13.7	15.5	15.4
CaO	0.57	0.07	2.79	10.5	2.01	7.34
Fe_2O_3	5.15	4.15	4.06	11.3	4.79	10.2
K_2O	0.40	3.73	1.84	0.7	0.21	0.94
MgO	0.53	0.01	0.34	4.97	0.77	6.37
MnO	0.32	0.10	0.60	0.21	0.34	0.24
Na_2O	4.33	5.73	1.43	2.63	2.37	3.90
P_2O_5	0.12	0.02	0.14	0.15	0.11	0.12
SiO_2	72.1	74.2	73.1	50.0	76.4	51.6
TiO_2	0.50	0.13	0.36	0.94	0.39	0.82
LOI	1.23	0.47	2.08	1.85	1.54	1.85

Geoduck and Shore - Continued

Element	15-25	15-26	15-27	15-28	15-29	15-30
	Concentration, Parts Per Million					
Ag	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
As	3	7	61	4	13	I
Au	0.01	<0.01	0.06	0.01	I	0.18
B	40	30	370	<10	50	140
Ba	350	250	160	310	400	150
Be	10	30	390	10	70	530
Bi	<0.5	<0.5	0.5	<0.5	<0.5	1.0
Br	<1	2	<3	4	5	<4
Cd	<0.2	<0.2	0.4	<0.2	<0.2	1.4
Co	8	25	3	37	5	<1
Cr	10	30	40	10	50	60
Cs	0.6	3.4	<0.8	6	1.7	<0.9
Cu	28	22	8	49	4.5	7
Ga	-	-	-	-	-	-
Ge	<10	<10	40	10	20	40
Hf	16	12	130	3	43	60
Li	10	30	40	270	20	20
Mo	<5	<5	I	<5	<5	<5
Ni	3	10	21	3	13	30
Pb	40	60	230	44	150	480
Pd	-	-	-	-	-	-
Pt	-	-	-	-	-	-
Rb	70	250	130	570	110	50
Sb	0.5	2.3	17	1.2	3.0	2.4
Sc	10.9	30.2	4.4	36.4	5.34	0.1
Se	<3	<3	I	<3	<20	63
Sn	-	-	-	-	-	-
Sr	400	640	80	270	660	40
Ta	11	29	150	2	27	71
Te	-	-	-	-	-	-
V	400	110	110	470	60	30
W	3	<3	I	<3	<5	I
Zn	110	500	1600	320	420	1400
	Concentration, Percent					
Al_2O_3	16.8	15.1	4.55	14.0	15.5	4.16
CaO	2.89	7.65	1.98	4.60	2.57	0.34
Fe_2O_3	4.43	12.85	5.74	15.1	4.44	4.06
K_2O	1.14	1.48	0.47	1.85	1.08	0.52
MgO	0.98	4.68	0.70	4.63	1.15	0.13
MnO	0.11	0.28	0.30	0.26	0.16	0.44
Na_2O	6.65	3.98	2.93	4.20	5.82	2.33
P_2O_5	0.06	0.15	0.11	0.07	0.07	0.10
SiO_2	64.8	49.7	76.6	51.2	64.0	77.5
TiO_2	0.98	0.42	0.49	1.27	0.45	0.34
LOI	1.39	2.31	1.70	2.93	2.39	1.16

Element	15-31	15-32	15-33	15-34	15-35	15-36
	Concentration, Parts Per Million					
Ag	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
As	<2	I	I	I	2.8	3.1
Au	0.3	I	0.04	I	<0.01	0.01
B	10	190	20	190	10	90
Ba	160	400	540	110	340	670
Be	20	190	<10	420	10	80
Bi	1.0	<0.5	<0.5	0.5	<0.5	<0.5
Br	1	<1	<1	<4	<1	1
Cd	<0.2	<0.2	<0.2	2.4	<0.2	<0.2
Co	2	8	44	1	52	21
Cr	20	60	20	40	10	10
Cs	0.9	<0.8	<0.5	<1.1	1.0	1.2
Cu	2.5	4.5	100	16	120	77
Ga	-	-	-	-	-	-
Ge	10	10	10	30	10	10
Hf	7	71	2	86	2	16
Li	50	20	10	10	10	<10
Mo	<5	<5	<5	<5	<5	<5
Ni	2	21	21	23	27	5
Pb	340	120	72	380	86	46
Pd	-	-	-	-	-	-
Pt	-	-	-	-	-	-
Rb	80	110	60	20	50	70
Sb	2.1	2.9	1.4	3.8	1.0	1.1
Sc	14.3	8.96	43.8	0.81	54.4	13.7
Se	<3	<20	<3	I	<3	<10
Sn	-	-	-	-	-	-
Sr	<20	810	610	630	740	840
Ta	36	52	1	100	3	21
Te	-	-	-	-	-	-
V	20	130	450	60	520	220
W	<3	I	I	I	<3	<3
Zn	600	930	380	5900	40	610
	Concentration, Percent					
Al_2O_3	14.0	11.3	16.0	5.25	16.1	17.4
CaO	0.15	6.43	8.63	4.04	11.3	7.40
Fe_2O_3	5.15	6.37	13.0	4.62	14.1	9.01
K_2O	0.54	1.17	1.15	0.11	0.89	1.44
MgO	0.44	2.43	6.05	0.69	6.40	3.94
MnO	0.17	0.42	0.23	0.42	0.27	0.23
Na_2O	8.51	3.40	2.19	0.71	1.61	3.67
P_2O_5	0.02	0.09	0.10	0.63	0.07	0.20
SiO_2	69.9	61.9	47.6	73.2	44.9	52.9
TiO_2	0.42	0.52	0.92	0.39	1.04	0.64
LOI	0.85	1.16	3.00	1.54	2.47	1.85

Geoduck and Shore - Continued

Element	15-37	15-38	15-39	15-40	15-41	15-42
	Concentration, Parts Per Million					
Ag	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
As	3.6	I	I	21	I	I
Au	0.01	I	I	I	I	I
B	100	160	1000	1500	1100	750
Ba	860	170	150	190	200	130
Be	40	290	790	730	670	560
Bi	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Br	1	<1	<5	<1	<6	1
Cd	<0.2	<0.2	0.4	1.2	1.2	0.4
Co	20	2	7	9	6	6
Cr	10	50	50	50	50	40
Cs	2.2	I	<1.3	<1.2	<1.1	<1.0
Cu	29	7.5	5.0	13	15	6.5
Ga	-	-	-	-	-	-
Ge	10	30	30	30	50	40
Hf	17	62	47	50	48	50
Li	10	<10	10	10	10	<10
Mo	<5	<5	<5	<5	<5	<5
Ni	7	17	22	22	24	17
Pb	44	140	360	190	320	440
Pd	-	-	-	-	-	-
Pt	-	-	-	-	-	-
Rb	100	40	40	60	40	30
Sb	1.4	3.1	6.5	9.0	6.6	9.3
Sc	15.6	6.28	1.53	1.30	2.11	1.36
Se	<7	40	I	<30	I	<5
Sn	-	-	-	-	-	-
Sr	760	690	1300	380	1200	640
Ta	19	67	150	160	160	250
Te	-	-	-	-	-	-
V	220	160	130	60	100	40
W	<3	I	I	I	I	I
Zn	500	570	3800	1800	2200	1400
	Concentration, Percent					
Al_2O_3	17.6	12.5	6.39	5.93	4.88	3.48
CaO	6.50	2.88	7.55	5.9	4.55	4.11
Fe_2O_3	8.40	3.64	5.24	4.93	2.97	3.40
K_2O	1.60	0.28	0.13	0.15	0.32	0.04
MgO	3.70	0.68	1.60	1.60	0.79	0.67
MnO	0.21	0.21	0.81	0.58	0.47	0.45
Na_2O	4.03	5.73	1.33	1.13	1.25	0.61
P_2O_5	0.19	0.11	0.06	0.05	0.06	0.03
SiO_2	53.1	67.6	62.6	66.1	72.1	76.7
TiO_2	0.66	0.53	0.25	0.25	0.26	0.36
LOI	2.23	1.54	2.08	1.54	2.08	1.31

Geoduck and Shore - Continued

Element	15-43	15-44	15-45	15-46	15-47	15-48
			Concentration, Parts Per Million			
Ag	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
As	21	72	92	I	3	<4
Au	I	I	I	<0.01	<0.01	<0.04
B	1100	300	1300	30	20	520
Ba	200	170	300	160	620	500
Be	700	500	440	<10	50	550
Bi	<0.5	0.5	0.5	<0.5	<0.5	<0.5
Br	<5	<4	<3	<1	2	<4
Cd	0.4	6.8	2.4	0.4	<0.2	<0.2
Co	9	<1	1	1	4	3
Cr	50	50	50	10	20	40
Cs	2.8	3.2	<1.0	<0.5	<0.6	<3.0
Cu	6.0	7.5	8.5	2.5	2.5	3.5
Ga	-	-	-	-	-	-
Ge	40	30	30	<10	20	50
Hf	42	130	55	22	10	34
Li	20	<10	10	10	<10	<10
Mo	<5	<5	<5	<5	<5	<5
Ni	19	33	27	2	6	11
Pb	140	2200	1500	10	44	180
Pd	-	-	-	-	-	-
Pt	-	-	-	-	-	-
Rb	30	<20	<20	160	80	50
Sb	8.3	8.1	11	0.5	1.3	8.5
Sc	3.4	0.32	0.21	0.34	3.8	1.8
Se	<12	I	I	<3	<3	<100
Sn	-	-	-	-	-	-
Sr	800	370	140	90	1800	1200
Ta	200	160	96	4	36	180
Te	-	-	-	-	-	-
V	100	50	30	<10	60	40
W	I	I	I	I	<3	I
Zn	3100	4200	7200	220	840	1500
			Concentration, Percent			
Al_2O_3	7.92	4.51	3.93	12.4	14.8	11.2
CaO	6.04	1.33	2.13	0.77	4.28	3.26
Fe_2O_3	4.63	4.08	3.33	0.85	3.10	2.42
K_2O	0.28	0.04	0.12	3.21	1.58	0.71
MgO	1.54	0.26	0.37	0.02	0.84	0.79
MnO	0.72	0.71	0.81	0.04	0.10	0.47
Na_2O	2.39	2.83	3.01	5.13	4.99	5.34
P_2O_5	0.09	0.07	0.04	0.02	0.11	0.07
SiO_2	64.8	74.1	74.8	76.5	68.5	71.7
TiO_2	0.33	0.36	0.30	0.09	0.30	0.25
LOI	1.31	1.23	0.92	0.93	1.31	1.54

Placer Sample Results

Element	16-1	16-2	16-3	16-4	16-5	16-6
	Concentration, Parts Per Million					
Ag	<5	<5	<5	<5	<5	<5
As	3	6	2	8	3	3
Au	0.065	0.007	0.030	0.210	0.007	0.007
B	-	-	-	-	-	-
Ba	310	460	240	260	200	170
Be	-	-	-	-	-	-
Bi	-	-	-	-	-	-
Br	8	7	6	7	9	9
Cd	<10	<10	<10	<10	<10	<10
Co	<10	<10	<10	13	17	19
Cr	240	240	210	200	150	150
Cs	1	<1	<1	<1	<1	<1
Cu	-	-	-	-	-	-
Ga	-	-	-	-	-	-
Ge	-	-	-	-	-	-
Hf	332	313	83	110	10	28
Li	-	-	-	-	-	-
Mo	<2	<2	<2	<2	<2	<2
Ni	<50	<50	<50	<50	<50	<50
Pb	-	-	-	-	-	-
Pd	-	-	-	-	-	-
Pt	-	-	-	-	-	-
Rb	68	48	60	48	16	13
Sb	0.9	0.8	0.5	0.6	0.3	0.4
Sc	13.0	11.0	10.0	11.0	27.0	35.0
Se	<10	<10	<10	<10	<10	<10
Sn	<200	<200	<200	<200	<200	<200
Sr	-	-	-	-	-	-
Ta	6	7	4	4	<1	1
Te	<20	<20	<20	<20	<20	<20
V	-	-	-	-	-	-
W	9	14	4	6	<2	<2
Zn	<200	240	<200	220	<200	<200
Zr	10000	14000	3900	4900	<500	1100
Cb	-	-	-	-	-	-
Th	140	193	50	85	5	16
U	58	75	22	37	3	7
Ce	450	510	210	260	52	100
Eu	3	<2	<2	<2	<2	<2
La	180	210	80	100	20	38
Lu	15	19	6	6	1	2
Sm	32	36	16	22	6	9
Tb	10	12	4	6	<1	2
Yb	99	130	37	42	5	12
Y	-	-	-	-	-	-

Placer Sample Results - Continued

Element	16-7	16-8	16-9	16-10	16-11	16-12
	Concentration, Parts Per Million					
Ag	<5	<5	<5	<5	<5	<14
As	3	7	4	3	2	<4
Au	0.015	0.083	0.059	0.017	0.056	0.038
B	-	-	-	-	-	-
Ba	140	220	300	220	370	<290
Be	-	-	-	-	-	-
Bi	-	-	-	-	-	-
Br	10	10	9	6	8	<5
Cd	<10	<10	<10	<10	<10	<25
Co	20	13	<10	<10	12	<10
Cr	160	150	240	230	250	250
Cs	<1	<1	<1	<1	<1	3
Cu	-	-	-	-	-	-
Ga	-	-	-	-	-	-
Ge	-	-	-	-	-	-
Hf	29	11	130	212	208	393
Li	-	-	-	-	-	-
Mo	<2	8	<2	<2	<5	<2
Ni	<50	<50	<50	<50	<50	<67
Pb	-	-	-	-	-	-
Pd	-	-	-	-	-	-
Pt	-	-	-	-	-	-
Rb	13	31	67	49	47	<36
Sb	0.6	0.5	0.8	0.8	0.6	0.6
Sc	34.0	24.0	11.0	15.0	12.0	17.0
Se	<10	<10	<10	<10	<10	<36
Sn	<200	<200	<200	<200	<200	700
Sr	-	-	-	-	-	-
Ta	<1	<1	5	11	10	58
Te	<20	<20	<20	<20	<20	<87
V	-	-	-	-	-	-
W	<2	<2	15	7	5	14
Zn	<200	<200	<200	<200	<200	<460
Zr	1400	<500	5500	11000	9300	14000
Cb	-	-	-	-	-	491
Th	13	6	47	86	81	415
U	7	8	29	49	44	121
Ce	91	62	250	390	380	1680
Eu	<2	<2	<2	<2	2	6
La	33	20	100	180	150	809
Lu	2	1	7	9	9	27
Sm	9	6	19	34	29	132
Tb	2	1	5	8	7	33
Yb	9	6	51	54	58	170
Y	-	-	-	-	-	-

Placer Sample Results - Continued

Element	16-13					
	Concentration, Parts Per Million					
Ag	<5					
As	4					
Au	0.065					
B	-					
Ba	250					
Be	-					
Bi	-					
Br	<5					
Cd	<10					
Co	<10					
Cr	170					
Cs	<1					
Cu	-					
Ga	-					
Ge	-					
Hf	291					
Li	-					
Mo	<2					
Ni	<50					
Pb	-					
Pd	-					
Pt	-					
Rb	47					
Sb	0.7					
Sc	10.0					
Se	<10					
Sn	220					
Sr	-					
Ta	16					
Te	33					
V	-					
W	7					
Zn	220					
Zr	11000					
Cb	232					
Th	117					
U	68					
Ce	510					
Eu	<2					
La	200					
Lu	10					
Sm	43					
Tb	11					
Yb	57					
Y	-					